REPORT RESUMES

ED 017 926 24 AL 001 193
SCIENCE INSTRUCTION IN SPANISH FOR PUPILS OF SPANISH SPEAKING BACKGROUND, AN EXPERIMENT IN BILINGUALISM. FINAL REPORT.
BY- RAISNER, ARNOLD AND OTHERS
NEW YORK CITY BOARD OF EDUCATION, BROOKLYN, N.Y.
REPORT NUMBER BR-5-1063 PUB DATE JUN 67
REPORT NUMBER CRP-2370
CONTRACT OEC-5-10-033
EDRS PRICE MF-$1.00 HC-$8.12 201P.

DESCRIPTORS- *SPANISH SPEAKING, *SCIENCE CURRICULUM, *BILINGUALISM, *JUNIOR HIGH SCHOOL STUDENTS, CURRICULUM EVALUATION, PUERTO RICANS, SCIENCE PROGRAMS, SECOND LANGUAGE LEARNING, *PROGRAM EVALUATION, SCIENCE EDUCATION, SELF CONCEPT, PARENT STUDENT RELATIONSHIP, NEW YORK CITY,

A STUDY WAS UNDERTAKEN TO DETERMINE THE EDUCATIONAL EFFECTS OF A LANGUAGE MAINTENANCE PROGRAM USING SPANISH AS A MEDIUM OF INSTRUCTION WITH JUNIOR HIGH SCHOOL STUDENTS OF SPANISH-SPEAKING BACKGROUND. THE PROGRAM'S EXPERIMENTAL VARIABLE CONSISTED OF BILINGUAL SCIENCE INSTRUCTION AND AN ACCELERATED COURSE IN THE SPANISH LANGUAGE. THE 994 SEVENTH-GRADE STUDENTS WHO BEGAN THE PROGRAM IN SEPTEMBER, 1964, HAD A HISPANIC BACKGROUND AND ORAL ABILITY IN SPANISH BUT LESS THAN GRADE LEVEL ENGLISH READING ABILITY. THEY WERE DIVIDED INTO 16 CONTROL AND 16 EXPERIMENTAL CLASSES, ALL OF WHICH FOLLOWED THE "NEW YORK CITY SCIENCE COURSE OF STUDY FOR THE JUNIOR HIGH SCHOOLS." THE EXPERIMENTAL "SCIENCE-SPANISH" CLASSES RECEIVED SPECIAL SPANISH LANGUAGE SCIENCE MATERIALS IN ADDITION TO THE STANDARD ENGLISH SCIENCE TEXT MATERIAL. EACH SCIENCE-SPANISH CLASS WAS TAUGHT BY A BILINGUAL TEACHER LICENSED TO TEACH SCIENCE WHO ENCOURAGED MAXIMUM USE OF SPANISH IN SCIENCE CLASSES AND LABORATORY PERIODS. IN ADDITION, THE EXPERIMENTAL CLASSES RECEIVED SPANISH LANGUAGE INSTRUCTION IN WHICH THE AUDIOLINGUAL METHOD WAS DEEMPHASIZED IN FAVOR OF MORE FORMAL CONTRASTIVE STUDY OF GRAMMAR, WRITING, AND CORRECT USAGE. AFTER THREE YEARS, AN EXTENSIVE EVALUATION OF THE PROGRAM WAS MADE IN THREE AREAS--(1) STUDENT ACHIEVEMENT (ESPECIALLY IN SCIENCE AND SPANISH), (2) PERSONAL AND SOCIAL DEVELOPMENT (INCLUDING BILINGUAL DOMINANCE AND CULTURAL ATTITUDES), AND (3) THE REACTIONS OF THE PROFESSIONAL STAFF TO THE PROGRAM. EXPERIMENTAL GROUP ACHIEVEMENT WAS FOUND TO BE SUPERIOR IN SCIENCE AND SPANISH, BUT WAS NOT AFFECTED IN SOCIAL STUDIES OR MATHEMATICS. IN THE AREA OF CLASSROOM ENGLISH ACHIEVEMENT, THE EXPERIMENTALS DID AS WELL AS THE CONTROLS, WHILE IN ENGLISH READING ABILITY THEY DID MUCH BETTER. EVALUATION ALSO REVEALED THAT THE BILINGUALLY TAUGHT CHILDREN TENDED TO RETAIN THE PARENTAL CULTURE, POTENTIALLY STRENGTHENING THE BOND BETWEEN CHILD AND HOME. PROFESSIONAL STAFF RESPONSES INDICATED A GENERALLY FAVORABLE REACTION TO THE PROGRAM. RECOMMENDATIONS FOR FUTURE BILINGUAL PROGRAMS ARE INCLUDED IN THIS FINAL REPORT. (JD)

ED017926

SCIENCE INSTRUCTION IN SPANISH FOR PUPILS OF SPANISH SPEAKING BACKGROUND

An Experiment in Bilingualism

COOPERATIVE RESEARCH PROJECT NO. 2370

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BUREAU OF EDUCATIONAL RESEARCH
BOARD OF EDUCATION OF THE CITY OF NEW YORK

BR-5-1063
PA 24

FINAL REPORT
Project No. 2370
Contract No. 407-9

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

June 1967

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Arnold Raisner, Philip Bolger, Carmen Sanguinetti

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AL 001 193

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The research reported herein was performed pursuant to a contract with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

OFFICE OF EDUCATIONAL RESEARCH
BOARD OF EDUCATION OF THE CITY OF NEW YORK
J. Wayne Wrightstone, Assistant Superintendent

BUREAU OF EDUCATIONAL RESEARCH
Samuel D. McClelland, Acting Director

PREFACE

The day-to-day conduct of the project was accomplished by a team of three members. The project team had to expedite the implementation of the program in the participating schools, create and distribute curriculum materials and instruments and conduct all evaluation activities.

Dr. Arnold Raisner was the Project Director and was in charge of the total program. Under general supervision, he was responsible for seeing that the project was carried out according to the contract and managed the program in its operational, research and curricular aspects. He also initiated important revisions in the project as dictated by its development over the three year period.

Dr. Philip Bolger was responsible for the research and evaluation aspects of the project. This included the design and construction of new instruments of evaluation, the collection and processing of data and the interpretation of findings.

Dr. Carmen Sanguinetti adapted and translated the curriculum material. Her activities embraced the preparation of teacher guides, student texts, work-books and examinations. She consulted with the school staffs in developing the specialized curriculum.

ACKNOWLEDGEMENTS

The evaluation of any large innovative educational program must involve the whole-hearted participation of a large number of teachers, administrators and researchers. The Science-Spanish Study was particularly well endowed with professional talent. The assigned group of skilled bilingual science teachers devoted long hours to the creation and use of Spanish language instructional material. They were called upon to prepare many special reports and to grasp every opportunity to develop the special teaching techniques which make bilingual instruction feasible. Deep appreciation is extended to these dedicated science teachers: Mr. Juan Fonseca, Mrs. Audrey Rivera, Mrs. Clara Gonzalez, Mr. Alexandro Rodriguez, Mrs. Emma Lou Carreras, Miss Eleanor Liden, Mrs. Mariluz Mermelstein, Mr. Jose Calero, Mr. Arthur Plotsker, Mr. John Orna, Mr. Randolph Douglas, Mr. Michael Nigro, Mr. Moises Rodriguez, Mrs. Shirley Nunes, Mr. Lloyd Torres and Mr. Vincent Foley.

The broad outlines of the program were originally conceived and sponsored by the late Dr. Joseph O. Loretan, Deputy Superintendent of Schools. His intellectual foresight and administrative skill paved the way for the development of an effective program. Mrs. Helene M. Lloyd, Acting Deputy Superintendent, continued his work.

The original grant proposal and research design were prepared by the expert hand of Dr. Samuel D. McClelland, Acting Director of the Bureau of Educational Research. Dr. McClelland served as co-director of the project and gave constant assistance and guidance.

Dr. J. Wayne Wrightstone, Assistant Superintendent in Charge of Research, provided the over-all direction of the program and the essential inspiration and editorial supervision.

A final word of gratitude is extended to the two excellent typists who served as specialists in the production of bilingual materials, Mrs. Dessia Trejo and Mrs. Bess Lasser. The typing of the final document is a tribute to the excellence of the work of our dedicated and highly skilled secretary and office coordinator, Mrs. Lillie Lasky.

A special note of thanks must be made to Mr. Richard F. Cumbo for his perseverance and diligence in caring for the varied business affairs inextricably related to the implementation of a project of this nature.

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CHAPTER I

INTRODUCTION

Statement of the Problem

The present study seeks to determine the educational effects of bilingual instruction on junior high school students of Spanish-speaking background. The program's experimental variable consisted of bilingual science instruction and an accelerated course in the Spanish language.

Background of the Problem

The in-migrant brings with him the desire for a better life for which he expects to pay with his talent, his skills and his labor. He also usually brings with him a foreign language steeped in a complex of social attitudes, personal attachments and an inherited style of living. Economic and social realities of the new environment make his need to learn English quite pressing; personal, familial and cultural forces, however, influence him to retain the old language. The first generation of in-migrants usually become bilingual in varying degrees.

The public school systems of Eastern seaboard entry-points have traditionally, though not exclusively, functioned to assist the in-migrants and their children to acquire a basic familiarity with and, later, a mastery of the English language. State laws, similar to subdivision 2, Section 3204 of the New York State Education Law, and school policies insisting upon the education of children in English have been designed with the acculturating function in mind. When one recalls the millions of immigrants and their children, who have been acculturated and educated in urban areas, the accomplishment stands as a testimony to the public school systems of those cities.

Success in acculturation, however, has not been without its price. A vast reservoir of linguistic ability has been made dormant with the loss of facility in the foreign tongue. Furthermore, success in the acculturating task has not been universal. The degree to which English was mastered and used in the in-migrant home or in the in-migrant neighborhood within the entry-city varied from family to family, neighborhood to neighborhood, and from linguistic group to linguistic group. The degree to which English was mastered and used in the child's environment frequently affected his ability to function in English and to achieve in school.

The process of acculturation, generally, resulted in adoption of the English language by the second generation children more frequently than by the first generation inmigrants. This process tended to create a linguistic separation regarding bilingual dominance between the first generation inmigrant and second generation offspring. Frequently the role value of the parents was diminished to some extent since the language of the home was not necessarily the language of vertical social and economic mobility. This diminution of the home's role value was not a serious problem for those children who acculturate rapidly and moved up the ladder of social and economic opportunity. But for those children to whom the rungs of these ladders are too far apart, the loss of connection with the home and the inability to advance within the host society leave them in a cultural hiatus.

During an era in which less than half the native population graduated from high school, acculturation and school achievement were not essentials to earning a living. The pretechnological working world offered ready markets for the skills and labor of the immigrant and his children. The high school diploma was not a prerequisite for a job application form. The untutored and the less gifted could find an income producing role in our society. The problem for the second generation child who did not advance socially and economically, regardless of cause, was not acute. Today, however, the cumulative effects of technological changes and higher educational requirements have diminished the labor market which traditionally provided the means of purposive, rewarding living for that group. The problem has been seriously aggravated.

Bilingualism in the Education of the Inmigrant

Since the Second World War educators have been considering the revision of present policy. Voices have been raised calling for language maintenance programs, bilingual education and preservation of the child-home bond. Meanwhile, in New York City large number of in-migrants from Puerto Rico arrived between 1950 and 1959. In October of 1959 a survey indicated that one in every four children in the sixth grade was an in-migrant (27). Other elementary grades had similar distributions. Extensive studies were designed to review the special needs of the Puerto Rican student (28). A curriculum was prepared, bilingual personnal were assigned, class size was reduced, guidance services were increased, funds for material were allowed and, in general, all standard procedures for instructional improvement were initiated. In his testimony concerning the bilingual education act Dr. Nathan Brown, Deputy Superintendent of Schools in New York City, reviewed in detail the various programs implemented in New York City specifically designed to aid the Spanish-speaking child (5).

Despite these efforts it had become apparent that the hope of bringing the students into the mainstream of academic life, within a generation, had fallen short of its goal. The Puerto Rican students were not represented in the high school academic courses of study in proportion to their total number. By continuing traditional policies and more recent innovations the goals still were not being attained. Causative factors included high pupil mobility rate, the negative effects of disadvantaged areas, English language proficiency as a requirement for advanced study. Inadequate school motivation stemming from an inappropriate "self-view" was also deemed to be a vital factor in the determination of academic success.

A closer look at the psychological effects of the cultural reconstruction of a student might be of value. Upon placement in class the student is given to understand that although many of his peers speak his language, that language should not be spoken in school. Inadvertenly the child's native language appears downgraded to some students. This supposed rejection of his language disturbs the personal value system, interfamilial relationships and the students' developing self-image. School efforts to offset this effect by putting Spanish music books into the elementary schools, by providing Spanish books in the library and by conducting Hispanic-oriented clubs and programs do not completely efface the effects of language restriction for some children.

While the student is learning English and adjusting to his new environment he misses the work of his grade. Only a very superior intelligence or a very dedicated and persistent application of effort could overcome the difficulties involved. Some students succeed; others do not. These latter hearken to the more realistic values and objectives of their peer group. The magnetism of this adolescent sub-culture draws the student from the applied effort necessary for academic success.

In an attempt to offset this apparent tendency schools have organized programs of Inter-cultural Appreciation. School plays for Brotherhood Week are well intentioned but serve as poor substitutes for the realities of life. The student can know that he is being recognized only when he achieves success in the academic areas which are truly stressed in schools. Despite the efforts of the schools to produce this happy state, it is becoming obvious that much more should be done.

The enthusiasm of the newly arrived student continues to be curdled by the process of acculturation.

> Initially, the overriding need to communicate provides the challenge and induces the motivation needed for applied school effort. The teacher does not have to explain the wisdom of acquiring a basic vocabulary. The child feels it - viscerally! After the vocabulary and basic patterns of speech have been mastered the student gets caught in the current that sweeps toward achieving social acceptance through language growth. The student draws his motivation from the acceptance standards of his sub-culture. He wants to be "in." He wants to satisfy the standards set by his peers. Motivation is "tailor-made" at this point. Subsequent to this second stage the student is likely to experience a loss of the stimulus needed to boost his efforts toward the succeeding rungs of language excellence. He has reached the junior high school plateau. At this point a new reference structure must become apparent to him; the need to prepare himself for high school and an eventual vocation. He must examine his aspirations in the light of his abilities. He must become sensitive to what is expected of him by his family, his peers and the authority of the school. His inspiration can be no stronger than the sum of the socio-psychological influences acting upon him (30).

On April 28, 1965 the New York City Board of Education issued a policy statement entitled Excellence for the Schools of New York City. It was stated that "bilingualism and biculturalism will be encouraged for all pupils, particularly Spanish-speaking ones, as an aspect of excellence which will benefit our community and nation in their relationship to a multi-cultured world" (3).

To use Spanish exclusively as the vehicle of instruction is to ignore the prime necessity of having the student eventually mastering English. It must also be understood that students who came to the United States and entered the primary grades, had their growth in the mother tongue curtailed so that by the later grades it could no longer serve as a functional tool for continued academic growth. We have inherited a situation which has led to student language limitation in both Spanish and English. With proficiency in neither language the prospect of academic success is virtually nil. With one language reinforcing a second in an atmosphere devoid of an anxiety inducing prohibition against either, it was hypothesized that we may provide the success experience needed for academic encouragement.

Bilingualism and the National Interest

In former years the large force of unskilled labor which was needed to operate our economy was partially supplied by the immigrant. What was an asset in a past era can constitute "social dynamite" in our present time. The phenomena of increasing industrial mechanization and automation coupled with our population expansion and urbanization have eliminated our former need for a large reservoir of unskilled labor and substituted a void in the area of technically trained manpower. A citizen without an immediately saleable skill must be sustained by welfare and unemployment supports until he acquires a skill which fits the economic demand.

Recognition of the massive shift of manpower needs has motivated our Federal Government to support extensive retraining programs for the poor and economically displaced. Avoidance of this kind of training would result in the extension of the unemployment roles and the concomitant drain on our economy and tax allotment. For the newly arrived immigrant the language barrier constitues a disability which is not easily eliminated. He has a stigma which may linger for an entire generation. We must apply whatever resources we have to the job of rapidly absorbing the new arrival into our economy in a self supporting stance. A second look at the principle of foreign language maintenance in our schools and in our economy is warranted by the obvious need to utilize the special language talents which the immigrant may already have. In 1964 Senator Robert F. Kennedy indicated before the Senate Sub-committee on Immigration and Naturalization that "of the 221,150 individuals that came to this country in 1964, 28,756 represent professional, technical and kindred workers, 6,822 represent managerial-proprietors and 24,000 clerical and kindred workers."

During the nine years from 1952 to 1961, 30,000 immigrants with engineering training entered this country, the equivalent of the entire United States graduating class of engineers in 1961. In the same period 14,000 physicians, 28,000 nurses, 4,900 chemists, 1,100 physicists and 12,000 technicians entered our gates. If we continue to require all to fit the "procrustean bed" of language requirement, we deprive our nation of badly needed skills and unwittingly assign these people to lower echelon positions where they may be displacing our own nationals. The new National Immigration Act of 1965 extends admission to immigrants of many new countries while setting employment skills as a criterion for entrance. The intent of the law would be sterile without a concomitant modification of our view regarding the role of cultural pluralism and bilingualism.

Mastery of a foreign language is considered a laudable achievement for the native born but is often viewed as a stigma to be disavowed by the immigrant. The status of the foreigner and his language is determined by the emotional outlook of the majority native population. While our nation was steeped in the isolationism of the early twentieth century a foreign accent or intonation was anathema to the American ear. Following the Second World War a growing awareness and respect for the world role of other nations modified the impression of our citizenry. The drain on our national pool of foreign language ability had become apparent. In 1958 "about one-third of our Foreign Service Officers seemed to have the knowledge of a foreign language necessary to meet fully the diplomatic, professional, and technical requirements of their posts." The National Defense Educational Act of 1958 moved to encourage the expansion of our foreign-language-ability reserve. A few months after its passage Senator Hubert Humphrey commented:

> This, however, is but the beginning of a vastly expanded program necessary to give the United States the linguistic capacity it must have in the years ahead. The exigencies of the situation demand that immediate emphasis be given to improving the language fluency of our Foreign Service officers, our military personnel, the members of our economic missions, and the hundreds of thousands of others who are serving United States interests abroad. This is of the highest urgency because these skills are needed---not tomorrow---but now. . . . As a nation we find ourselves deplorably unprepared linguistically, either to defend ourselves in the event of a Third World War, or to exercise the full force of our leadership in the building of a peaceful world. The sad fact is, while we are trying to win friends all over the globe, we can't communicate with three-fourths of the world's population in their native tongue.

The shortest route to the organization of a future cadre of foreign language "experts" is through the establishment of a language maintenance program for the foreign born. The Puerto Rican in-migrant is an American who needs training only in the academic and commercial fields in order to play a vital role in our expanding relations with South America.

The United States Office of Education is keenly aware of the need for change and is even now providing the financial and moral support for a great deal of work in the area of bilingualism and biculturalism (17). The government is presently supporting programs in Florida, Texas, California and Michigan, and this is only the start. Senator Ralph Yarborough has introduced a bill (S. 428, 17, Jan. 1967) entitled Bilingual American Education Act, which at this writing is in Senate subcommittee. This bill promises a cornucopia of funds for programs already undertaken by local school boards. Its declaration of policy as it appears in the Congressional Record reads as follows:

> In recognition of the special educational needs of the large number of students in the United States whose mother tongue is Spanish and to whom English is a foreign language, Congress hereby declares it to be the policy of the United States to provide financial assistance to local educational agencies to develop and carry out new and imaginative elementary and secondary school programs designed to meet these special educational needs.

The rationale as further emphasized in the same document is indicated as follows:

> It may be possible, to demonstrate the employment of the Spanish language and culture as leverage for educational adjustment and achievement rather than as a defect in the process of acclimation to an alien culture.
>
> We have a magnificent opportunity to do a very sensible thing---to enable naturally bilingual children to grow up speaking both good Spanish and good English, and thereby be in a position to go forth confidently to deal with the world, rather than retreat in embarrassment from a world which speaks a language which they can understand only imperfectly.

A major aspect of the Science-in-Spanish program relates to the attempt to assay the feasibility of instituting a language maintenance program not only through formal instruction in Spanish but through use of the language as a medium of instruction. Full acceptance of the legitimacy of the language and the social acceptance of its speakers are major steps toward bilingualism and biculturalism.

That the New York City school system accepts and endorses the principles of bilingual education was clearly indicated by Dr. Bernard Donovan, Superintendent of Schools, in his testimony before the House General Subcommittee on Education on July 7, 1967 (11). In his remarks he indicated:

> We are dedicated to the bilingual approach to this educational program. Although we stress the importance of full command of the English language, we also believe in the maintenance and strengthening of the child's language skills in the native tongue of the pupil or his parents. Bi-lingual programs can provide superior educational benefits.

Related Research

In order to be able to appreciate the scope and significance of the present study it is essential to consider its basic problems in the light of earlier findings. We should also bear in mind that final recommendations stemming from the findings of any study must be made in terms of reality factors as they are perceived by the investigator. It is with this outlook that the present reviewer of the literature aims at examining related work in the area of bilingualism in the schools and in the area of psycholinguistics.

Bilingualism in the Schools

The most comprehensive study of the special needs and progress of the Puerto Rican student in New York City was conducted by J. Cayce Morrison during a period extending from 1953 to 1957 (28). Dr. Morrison explored the most effective methods and materials for the teaching of English as a second language to newly arrived Puerto Rican pupils. He was also concerned with the determination of suitable instructional techniques for hastening the process of acculturation. He placed his greatest emphasis upon the actual preparation of material and the analysis of the relative merits of different methods of teaching the English language. His study of the psychological aspects of new language adoption related primarily to specific school adjustment problems which inevitably arose from the students' sudden plunge into an alien envioronment. In his recommendations, however, he strongly indicated that New York City should take a new look at the philosophy governing the education of the non-English speaking student. Several of his questions (28) are relevant to the present study.

> Does his education involve helping him to forget the language of his fathers? Does it involve creation of barriers between him and his parents? Does it subconsciously leave him to discover a "color line"? Does it quietly demonstrate that integration of ethnic groups is a two-way process? These questions purposely cut two ways. They are intended to challenge the remnants of a philosophy long since outmoded. They lie at the roots of the integration of ethnic groups in the school.

A significant experimental approach toward the development of a philosophy of bilingual instruction was initiated in Dade County, Florida in January 1962 (35). During the year 1961-62 Cuban pupils entered the country at the average rate of 250 a week. Today there are approximately 21,000 Spanish speaking students in the county schools. In exploring feasible methods of enhancing learning and acculturation the office of education established a bilingual school with two classes of Spanish-speaking pupils and two classes of English speaking pupils in grades one through four with eight native Spanish speaking teachers and eight English speaking teachers.

English was the medium of instruction for all pupils for approximately half of each day, and Spanish the medium of instruction for all pupils during the other half. The fifth grade was added to the program for the second year and the sixth grade joined the program for the third year. The expectation was that at the end of the sixth grade each group of pupils would know the two languages well enough to operate effectively in both.

It appears quite clear that the Miami experience in bilingual education could yield fruitful insights into the process of language acquisition and maintenance through bilingual instruction. Of particular interest is the developing attitude of the in-migrant toward the culture which he is assimilating. Dr. Pauline Rojas, Director of The Ford Foundation Bilingual Program has indicated* the importance of providing a continuation of the bilingual program on the secondary school level so that initial gains could be consolidated.

The bilingual program in Miami provides discrete periods for language emphasis. In New York City Dr. Finocchiaro (13) has recently attempted to demonstrate the functional use of bilingual communication on the kindergarten and first grade levels with pupils of a predominantly bi-ethnic constellation. It was hypothesized that the presence of two different language groups in the same classroom can be utilized to develop bilingual readiness in both English speaking and non-English speaking children. The investigators were also concerned with the development of positive pupil attitudes toward the language and culture of his classmates. The instructional program employed the simultaneous use of both target languages within the framework of the normal kindergarten and first grade curriculum. The findings have not yet been published but the significance of this direction of investigation is unquestioned.

It is important to note that provision for the bilingual student on the college as well as elementary school level are now being made. The recently established Elbert Covell College, a division of the University of the Pacific has instituted an engineering course of study which is rendered completely in Spanish. Students from Latin America can study together with bilingual students of the United States without having to first overcome their difficulties in English.

---

* Letter to Dr. Arnold Raisner from Dr. Pauline Rojas, Director, Ford Foundation Project, Dade County Public Schools, Miami Florida, Dated October 1965.

Psycholinguistics

One of the objectives of the present study was to encourage functional bilingualism. The learning process involved in mastering a new language, in a new country, while maintaining a background language through encouragement from school and home has been barely explored. However, some closely related work has been done by researchers in the area of bilingualism.

In 1956, Haugen (20) pointed out that little had been done in the field of psycholinguistics beyond the study of the effects of bilingualism upon intelligence test performance. Haugen feels that the "locus of bilingualism is in the individual mind." The psychological study of the bilingual is therefore of central importance in the analysis of bilingualism. Early psychologists have traced the development of native language from the babbling of infants to full mastery of self-expression (11). More recently, the effects of bilingualism upon the maturing student have been studied in greater detail.

Haugen (20) feels that the motivation for the effective learning of a second language must have its roots in the needed social adjustment. Similarly the extinguishing of a background language depends to some extent upon the individual's attitude toward the language. Ervin (11) refers to the psycho-social influences upon the child's receptivity to a new language. He indicates that a child adopts models which relate to his own identification (self-image). These studies are particularly relevant to that aspect of the present study which seeks to displace the students' discouraging view of his background language with a more positive, socially "advantaged" association. A student who can see the language of his home applied to the high prestige area of science study may hold himself and the value of his background in higher esteem.

Jensen (22) points out that there is a considerable body of research which indicates that the bilingual children may be handicapped in their intellectual development. He feels that the burden of two or three languages causes a child of normal intelligence to become mentally uncertain and confused. He may lack originality of thought and may be handicapped on intelligence tests. In addition, he cites evidence of research which finds that the bilingual may become schizophrenic. He experiences frustration and insecurity stemming from "his ineffectiveness as a communicator." According to Christopherson (6) these children feel a "pull in opposite directions which threatens the unity of their personality."

In the face of these possible difficulties a consistent theory of bilingualism was needed. Ervin and Osgood (10) theorized that there are two types of bilingualism; one in which each language is learned in its own environment or context, and the other in which the second language is learned by translation through the first. The former method results in a coordinate bilingual system while the latter leads to a compound bilingual system. Coordinate bilingualism can best be achieved by having the learner abandon his native language while he undertakes the learning of his second tongue.

Ervin's concept (11) of compound and coordinate bilingual language systems led to the development of Lambert's (24) scheme for the classification of bilinguals as having learned their two languages in either a separated or fused context. Acquisition was considered to be separated when one language was learned exclusively at home and the other exclusively in school or, more pertinent to this study, when one language was acquired in a particular national or cultural setting distinct from that in which the second was acquired. Acquisition was considered to be fused when both parents used both languages interchangeably inside and outside the home or when an individual acquired his second language in a school system stressing vocabulary and translation and where the first or native language was used as the medium of instruction. This would be the common situation of an American student studying a foreign language in school. Lambert found that separated language learning enhances the effectively separated use of the bilingual's two languages. Experience in separated contexts also comparatively increases the associative independence of translated equivalents in the bilingual's two languages. The ability to switch from one language to the other could not be related to the way in which the language was originally learned.

The acquisition of a new language is often accompanied by a diminution in the use of the background language. As the process of bilingual learning and forgetting take place the relative extent of use of each language at any particular point in time should be known.

Weinreich (44) stressed the importance of determining the extent of use and the context of use for each language in a so-called bilingual system. The extent of the use of either language can be marked theoretically on a scale which extends from little use to total use. To superimpose the "area of use" scale of one language on a similar scale constructed for a second language, is to determine a "use configuration" which could help to identify the student for future study of manifest characteristics.

More specifically Weinreich proposed that a dominance configuration be established for the two languages. This configuration would be determined by a host of relevant characteristics such as the bilingual's relative proficiency, his mode of use (speech or writing), order of learning and age, usefulness in communication, emotional involvement, function in social advance, and literary-cultural value. In the present study selected aspects of the total dynamic interaction of the above factors were examined.

Fishman (16) states, "Dominance configurations may be used to summarize data on the bilingual behavior of many individuals who constitute a defined sub-population. Repeated dominance configurations for the same population, studied over time, may be used to represent the direction (or flow) of language maintenance and language shift in a particular multilingual setting." It is precisely this shift which may give us the clue to the contrastive effects of different methods of instruction which are involved during the process of studied acculturation and cognition.

Vital aspects of the process of language maintenance have been high-lighted by Fishman and Nahirny (15) who indicate that parent and teacher attitude toward the language maintenance effort are key factors in student success. It has been further shown that where one language was learned prior to interaction with another, reading or writing in the mother tongue may resist shift more than does speaking. Therefore, scales developed to measure bilingual dominance, especially among subjects not classified previously as coordinate or compound bilinguals, should include items eliciting frequency of language use in such media as reading writing and speaking. It was also found that where language shift is unconscious or restricted, inner speech may be most resistant to interference: where language shift is desired, inner speech may be least resistant to interference. Hence, Bolger (4) concludes, it is important that a measure of bilingualism consider the subject in his many life roles.

Stemmler (38) indicates the importance of student preconditioning in relation to material being learned or attitudes being assumed. A student from an environment fraught with economic and cultural deprivation is likely to view the meaning of specific words and social relationships quite differently from students originating from a more favorable environment. The ecology of cognition reveals the subtle influence of social attitudes and self-image upon the learning effort of students.

In the present study we are concerned with the fostering of a positive attitude toward the "self" and the position of the "self" in relation to the material being presented. Stemmler indicates further, that in writing and in teaching an audience, "set" must be presumed by the instructor. If the true "self" is alien to the presumed "self" a consistent pattern of meaning distortion takes place. The study of science through the students' background language may help to fuse the effort of study with the fulfillment of "self".

Dr. Simon Silverman, Director of the New York City Bureau of Child Guidance has emphasized the need for a "closer tie-in between the culture of the old country and the child" in New York City. He stressed the importance of close identification between the child and his teacher for the enhancement of the child's self-image and greater respect for the durability of his culture.

Specific Purposes and Objectives

The purposes of the experimental instructional program were to achieve the following aims for the selected sample population of New York City students of Spanish-speaking background.

a. To increase the students' knowledge of Spanish language, and culture through classes taught by licensed teachers of Spanish.
b. To increase the students' knowledge of English language, through classes taught by licensed teachers of English.
c. To increase the students' knowledge of science by having them taught by bilingual teachers of science.
d. To raise the students' self-image, morale and aspirations by nurturing their pride in their Spanish origins.
e. To create in the student an appreciation of the fact that American democracy does not require sterile cultural uniformity.

The objectives of the evaluation program included the following:

a. To measure and evaluate the levels of proficiency attained in Spanish and in science.
b. To ascertain status and changes in attitudes, emotions, motivation, and other personality factors.
c. To compare the attainments of this sample population with those of control groups taught by present methods.

Hypotheses

The main research hypotheses were that, within the limitations of the measures used, the sample experimental population would be found to be superior to the control population to a statistically significant degree at the .05 level of confidence, in each of the following respects:

a. Knowledge and facility in Spanish language
b. Achievement in junior high school science
c. Personal values, self-image
d. Motivation and level of aspiration
e. Emotional adjustment
f. Social adjustment

It is further hypothesized that the experimental population will not be statistically inferior to the control population in knowledge and facility in English language.

CHAPTER II

DESIGN OF STUDY

Introduction

The present investigation followed a "before-and-after" type design using control and experimental groups. All groups were measured at the outset and at the conclusion of the study. The longitudinal design was originally planned to evaluate the effects of bilingual instruction in the junior high schools, with the indicated group, over a three year period. However, large scale school-grade reorganization in New York City converted many schools from an organization with grades 7, 8 and 9 to one having grades 6, 7 and 8. As a consequence, this report covers the progress of those students who completed grades 7 and 8 only. Results of the third year study of the schools not affected by the reorganization has been undertaken and will be reported at a future date.

The controlled phenomena that were introduced into the experimental and not the control classes were, first, the encouraged use of the Spanish language in the regular science class under the direction of a bilingual science teacher and second, the presentation of a new advanced course of study in Spanish designed to accelerate student progress by using their background skill in the Spanish language.

The sequence of steps undertaken in this study included the following:

Selection of Schools

Screening and Assignment of pupils to experimental and control classes on a random basis

Selection of Specialized Teachers

Preparing suitable instruments for evaluating areas of change

Obtaining initial scores and measures of student abilities and attitudes

Preparation of Science Course of Study in Spanish

Preparation of Accelerated Spanish Language Course

Final Testing and Collection of Data

A detailed description of each of these steps will be reported in this chapter.

Selection of Schools, Students and Teachers

This experiment began formally in September, 1964 in sixteen junior high schools in New York City. The schools were selected to be representative of areas having the most Spanish-speaking children. Special attention was given to the selection and inclusion of different types of Spanish-speaking communities. Older communities were balanced with communities composed of more recent arrivals. To locate these areas the ethnic distribution records available at the Bureau of Program Research and Statistics, Board of Education of the City of New York, were consulted for the school year 1963-1964. Table 1 summarizes the relevant data for determining the areas in which schools were to be selected.

Table 1

Number and Percentage of Hispanic-Background Students in New York City Junior High Schools, October 31, 1963

Borough	Total No. of All Pupils	No. of Puerto Rican Pupils	Percentages Puerto Rican
Manhattan	36,307	11,899	32.8%
The Bronx	45,572	11,892	27.9%
Brooklyn	76,108	12,254	16.1%
Queens	47,988	1,020	2.1%
Richmond	5,202	124	2.4%
TOTAL	208,177	37,189	Mean %=17.9%

The data revealed that the largest proportion of Hispanic-background children were in Manhattan, The Bronx and Brooklyn; accordingly, schools were selected from these boroughs. Other information published by the Board of Education indicated there were thirty-two junior high schools in the city with Hispanic-background registers of ten per cent or more (4). The sixteen schools eventually selected from the thirty-two schools were so selected because of staffing and administrative requirements later explained under the heading Selection of Teachers. The sixteen participating schools were representative of junior high schools heavily saturated with Hispanic-background students in an urban area. The number and per cent of Hispanic-background students in the sixteen schools ultimately selected are presented in Table 2 . The sixteen schools are referred to by numbers; these letters will be used hereafter whenever reference is made to individual schools.

Table 2

Number and Percentage of Hispanic-Background Students in Participating Junior High Schools, October 31, 1963

Borough	School	Total School Enrollment	Number Hispanic-Background	Percentage Hispanic
Manhattan	1	1500	837	55.8
"	2	1595	797	50.0
"	3	1615	906	56.1
"	4	1527	1005	65.8
"	5	1927	1169	60.7
"	6	1241	394	31.8
The Bronx	7	1265	675	53.4
"	8	1991	1378	69.2
"	9	975	619	63.5
"	10	1716	791	46.1
"	11	1931	1344	69.6
Brooklyn	12	1637	770	47.0
"	13	1847	1147	62.1
"	14	955	414	43.4
"	15	1977	837	42.3
"	16	1397	367	26.3
	TOTAL	23,097	13,450	Mean %=53.6

In the process of selecting teachers each of the 32 schools having ten percent or more Hispanic-background students was canvassed for the presence on the staff of licensed science teachers fluent in Spanish. Sixteen of the total number of possible schools had on their science staffs potential participants. For a teacher to be considered suitable for participation in the experiment he had to be at least an average science teacher as judged by his supervisors, licensed by the Board of Examiners, and have a basic ability to speak Spanish and to be willing to participate in the program. Of the sixteen potential schools nine had absolutely fluent science teachers while seven had teachers of Spanish-speaking background and orientation and were considered adequate within the framework of the program's objectives.

To insure competency in teaching science the following criteria had been established. First, the teacher had to be a licensed science teacher who had passed the examination of the New York City Board of Examiners. This certified at least that all teachers possessed the knowledge and skills deemed necessary to teach science by that Board. Second, principals in each of the sixteen potential schools were given the names of the science teachers in the school who were supposedly fluent in oral Spanish ability. They were requested to consult with the supervisory staff and indicate whether these teachers were considered average science teachers for that school. Once so rated, the teacher was to be asked if he would be willing to participate in the experiment.

To insure competency in Spanish-speaking ability the following procedure was instituted. Each teacher was interviewed by two different raters. Rater #1 was a mainland-born science teacher and assistant principal in the junior high schools. This rater studied Spanish in high school and college. Employed by the army in Puerto Rico to teach English to soldiers from that island, he served two years conducting classes using both languages. He is co-author of the military manual, entitled, Oral English Program for Spanish-Speaking Personnel (29).

Rater #2 was an island-born former instructor of Spanish-speaking science teacher trainees at the University of Puerto Rico. A staff member of The Puerto Rican Study (28) and a coordinator in the New York City public schools, she has been an American representative at conferences held in Guatemala. A teacher in both English and Spanish in Puerto Rico, California and New York City, her present capacity is that of translator and Curriculum Supervisor with The Science-Spanish Experiment.

Rater #1 interviewed each prospective teacher before the program was instituted in May of 1964, to judge the teacher's ability to speak Spanish. Evaluations were recorded on the Rating Form for Teacher Spanish Language Proficiency. Rater #2 went with the researcher to each of the nine schools after the program had been instituted and again rated the teacher, on the job, on the same form.

Nine teachers were rated fluent in Spanish oral ability by both raters, and seven teachers were categorized as meeting the minimum requirements for the program. They were referred to as "Spanish-oriented" teachers. To be rated fluent in Spanish a teacher had to receive an A or B rating on the adopted Puerto Rican Scale and a 4 or 5 on the item "Overall Summary Evaluation." A copy of the form is in the appendix but to make reader interpretation easier the items on the form are reprinted below:

Item - SUMMARY EVALUATION - Overall Fluency, smoothness, facility, correctness (of Spanish Usage by Teacher)

1 - Inferior
2 - Below Average
3 - Adequate
4 - Above Average
5 - Superior

Item - RATING IN TERMS OF THE PUERTO RICAN STUDY SCALE

A - Speaks Spanish as well as a native, with no foreign accent or hesitance due to interference of a foreign language.

B - Speaks Spanish with a foreign accent, but otherwise approximates the fluency of a native speaker. Does not hesitate because he must search for Spanish words and language forms.

C - Can speak Spanish well enough for most situations met by a typical native speaker, still must make a conscious effort to avoid the language forms of English. Speaks hesitantly upon occasion because of mental translation.

D - Speaks Spanish in more than a few stereotyped situations, but speaks it haltingly at all times.

E - Speaks Spanish only in those stereotyped situations for which he has learned a few useful words and expressions.

F - Speaks no Spanish

Teachers who were considered to be Spanish-oriented had to meet the same selective criteria as the Fluent Spanish-speaking science teachers with one exception; fluency in oral Spanish ability was not required. However, a knowledge of Spanish was required. Minimum criteria set were: first, they should have studied Spanish in school from four to five years, and, second, they had to have some Spanish-speaking ability: a rating of C, D or E, but not A, B or F, on the form.

The seven Spanish-oriented teachers were also interviewed by the two raters; none of them was classified as fluent in Spanish by either Rater. Table 3 exhibits the ratings received by each teacher from each of the raters.

Table 3

Ratings Received by Participating Teachers from Both Raters on the Rating Form for Teacher Spanish Language Proficiency

SCHOOL	Fluent Teachers				SCHOOL	Spanish-oriented Teachers			
	Rating on P.R. Scale		Overall Rating			Rating on P.R. Scale		Overall Rating	
	Rater #1	Rater #2	Rater #1	Rater #2		Rater #1	Rater #2	Rater #1	Rater #2
2	A	A	4	5	1	C	D	3	2
3	A	A	4	5	4	D	D	3	3
5	A	A	4	5	6	D	C	3	3
7	B	B	4	5	9	D	D	3	2
8	A	A	5	5	14	D	E	3	2
10	B	A	4	5	15	D	E	3	2
11	A	A	5	5	16	D	C	3	3
12	A	A	5	5					
13	A	A	5	5					

The selection of students and their random assignment to experimental and control classes were of prime importance. In the spring term of 1964 while the potential student participants were still in sixth grade elementary school, the elementary school guidance counselor worked with the junior high school non-English coordinators in selecting pupils for the study. The feeding elementary schools provided each junior high school the articulation cards of children to be sent to the respective junior high in the fall. These cards were reviewed for Hispanic-background students. To identify such children the cards were scanned for such relevant data as place of birth, languages spoken, birthplace of parents and other schools attended. A list of Hispanic-background students was then made from this initial source.

To isolate from this list students more than one term behind in reading but within a two year range of reading retardation the coordinator reviewed sixth grade reading scores from the New York City Reading Test, administered January, 1964 on a city-wide basis. A child reading on grade had a 6.5 score; a child one term behind scored 6.0. A 5.9 score, then, indicated a child at least more than one term behind; a 4.5 score indicated the child to be two years retarded in English reading.

After isolating a group of Hispanic-background students two years retarded in reading, the next procedure was to eliminate from this list students with severe emotional or behavioral problems. The guidance counselor in each feeding elementary school was asked to identify such children from the list of prospective participants sent her by the non-English coordinator. Judgments were made on the basis of previous entries on articulation cards, report card ratings and guidance office records. The aim was to allow a normal range of behavior types to participate except that those students whose previous behavior patterns had made instruction in class virtually impossible at times were to be excluded. This category included students with recognized histories of emotional problems that tend to require extraordinary care and provisions on the part of the teacher.

The junior high coordinator then visited each feeding elementary school to examine the remaining children for proficiency in oral Spanish. These children were rated for oral Spanish ability on the Scale for Rating Pupil's and Teacher's Ability to Speak Spanish developed for The Puerto Rican Study. Only students rated "C" or better were included.

Experimental Treatment

Each experimental class was taught science by a bilingual teacher licensed in the field of science. The course of instruction followed the recently developed New York City Science Course of Study for the Junior High Schools. It emphasizes understanding the important concepts underlying the four scientific disciplines, as well as the interrelationships among them. There is reorientation away from reliance on descriptive presentation toward demonstration and direct pupil experiences. Units of fundamental science content from the fields of chemistry, physics, biology, and the earth sciences are presented separately in the seventh, eighth and ninth grades. Logical development of each science is stressed.

The course of study calls for the study of science in the junior high schools of New York City as a major subject area, with the allocation of 4 periods per week in Grades 7 and 8 and 5 periods per week in Grade 9. The general approach is toward teaching science in depth with laboratory work as an integral part of science teaching. Licensed laboratory assistants are assigned to assure its successful operation. The teacher used the Spanish language in the science class, to the extent possible, and encouraged the students to do the same. Oral presentations as well as assigned readings were given in Spanish as well as in English when clarification was necessary. The conversational mood which was established during the teacher's lecture-demonstration and during the student laboratory periods was one of easy and permissive transition from one language to the other.

Readings and reference works in both Spanish and English were made available to the experimental students. All standard English science text material normally used in all other classes were made available to experimental students as well. Each week the coordinating office sent to the schools Spanish translations of important science material that was already available to the students in English; this included lists of vocabulary words relating to the week's work, science laboratory experiments, review tests, general concepts and text summaries. The classroom science research library contained a collection of suitable texts which were purchased from Spain, Argentina and Puerto Rico. Bilingual dictionaries were available in every room.

In order to provide for uniform instructional practices and policies the director of the project met periodically with each teacher individually, in order to discuss special classroom techniques suitable for encouraging the use of Spanish in the science class. An in-service course lasting for five months was organized by the project director for the purpose of providing a "clearinghouse" for ideas and techniques involved in bilingual instruction.

Where it was found that the teacher's fluency in Spanish flagged assistance was provided in the classroom instruction through the use of a special teacher known as a non-English coordinator. This teacher was assigned in several instances to be present during the scheduled science laboratory period. She would in essence, serve to maximize the use of Spanish in the learning process. In other instances where teachers were replaced temporarily by substitutes who were non-Spanish speaking a student translator would be used to provide the continuity in bilingual usage. Spanish word lists and manuals of common phrases were assembled and distributed for teacher's use. In essence, there were two variants of the main treatment. One treatment involved the use of the competent bilingual teacher. The other treatment involved the use of a less competent bilingual teacher who received assistance from the school's non-English coordinator. In both cases, however, the main purpose of infusing Spanish into the teaching of science in accordance with the design of the program was accomplished.

The experimental class also received instruction in formal Spanish. The students' ability in their background language had been acquired largely through use in the home situation. Their academic proficiency in the Spanish language left much to be desired. In order to fill this gap and in order to provide for the enhancement of the spirit of "free use of background language" a course in Spanish was given to all experimental students. They were scheduled to take the language for four 45 minute periods a week in the seventh and eighth grades and for five 45 minute periods in the ninth grade. The methods of foreign language instruction for this group were different from methods normally used with students who are studying foreign language for the first time. The audio-lingual method of instruction was deëmphasized in favor of a more formal contrastive study of language with emphasis upon grammar, written expression and correct usage.

Uniformity of instructional procedures were established for all classes in the program through cooperation with the supervisory staff of the Board of Education's Office of Foreign Languages. Periodic meetings of the foreign language coordinators were used to formulate a suitably accelerated course of study for experimental students. A calendar of content coverage was established and methods of cooperative supervision involving the school department chairman and the Office of Foreign Language Supervisor were established.

The course was designed to cover school Level I in the seventh grade, Level II in the eighth grade and finally level III which terminated in the New York State Three Year Regents Examination at the end of the ninth grade. The normal course of study in foreign language in New York City would aim at the completion of Level II over the same three year period.

Creation and Use of Specialized Science Instructional Material

Use of Spanish as the medium of instruction in the science class presupposed the availability of Spanish language text and laboratory material. The Science-Spanish program aimed at the presentation of both oral and text science material in Spanish. The allocation of instructional material followed the pattern indicated below:

The control class received the graded set of four soft-covered science textbooks in English. These books covered the areas of chemistry (42), physics (41), biology (40) and earth science (8). In addition, they received mimeographed copies of their weekly laboratory work sheets. The class science reference libraries included high school text books in each of the aforementioned areas and copies of books in specialized science areas which were obtained from the school library.

Students in the experimental class received all of the above mentioned English language material which was made available to the control students. In addition, they were afforded the opportunity of having the equivalent content material in the Spanish language in the following way. All laboratory experiment work sheets were translated into Spanish in the Science-Spanish administrative office and mimeographed copies were sent to the schools for distribution to students. These work sheets served as step-by-step guides for the students as they proceeded through their laboratory sessions. The sheets were cumulatively retained by the students so that they might serve to assist in future study and review.

In an attempt to make available Spanish language text material which could be used by students who were studying largely in Spanish, several steps were taken. For each topic studied a sequence of mimeographed Spanish language notes was prepared and distributed to all students. This sequence included several pages highlighting the general concepts being explored, vocabulary sheets, and selected translations from the English material. The students received their bi-weekly Spanish language "kit" about a week previous to their studying the topic in school.

In order to provide Spanish language text material which could be used for more detailed study, for review and for advanced study each student received a Spanish language science text (9) for his grade, cross referenced to the presentation followed in New York City. These books were purchased from the Office of Education in Puerto Rico.

Spanish language reference books (21) (26) (34) were purchased from Spain and Argentina and 20 copies of each book were made available in each school for use in the class science library. Standard Bilingual Dictionaries (45) were placed in all classrooms in order to aid students in the translation of technical and scientific terms. In this way the study provided for comparable student learning material in the experimental and control classes.

Both the experimental and control classes followed The New Course of Science Study developed under the direction of Mr. Samuel Schenberg, Director of Science Instruction in New York City schools. The course for grades 7-8-9 is part of a K-12 science program which was experimentally developed in order to provide for the logical and sequential presentation of scientific concepts from the four major science areas during each of the junior high school grades. The objectives of the program include the following:

- Develop the concepts, skills, knowledges, and attitudes which were begun in Grades K-6.
- Develop a firm scientific foundation, including laboratory skills upon which the program in Grades 10-12 can be built.
- Explore the various scientific disciplines for the development of individual interests and abilities.
- Explore the possibility of a satisfying and challenging career in a scientific field.
- Understand science as a unified whole by perceiving inter-relationships among the four fields of science.
- Appreciate the role of science in the progress of civilization and in the development of our technological society.
- Understand the methods employed by the scientist in his attack upon problems affecting the health and welfare of the human race and to rely upon his findings.
- Apply scientific methods and attitudes, where possible, as a way of life.

The program presented several major innovations in the teaching of science: Emphasis was placed upon concept development rather than upon the traditional reliance upon descriptive presentation. The inter-relationships among the four scientific disciplines were emphasized even though the actual topical sequences separated the fields of chemistry, physics, biology and the earth sciences. The integration of classroom lecture recitation and laboratory work was new on the junior high school level. The assignment of four 45 minute science periods a week allowed for scheduling double periods for laboratory work each week. This procedure necessitated the services of a full time school laboratory assistant. Throughout the program stress was placed upon science as a method of thinking, of investigation, and of operation. Students planned together, studied together and formulated their hypotheses after cooperative exchange of thought. Encouragement for the use of Spanish in this laboratory milieu was thought to be the most effective way of emphasizing the honest acceptance of the students backgroung language by the schools.

Special Instruments

The nature of the population studied and the character of the bilingual program precluded, in several instances, the use of available instruments standardized with monolingual populations. This necessitated the development of special instruments to secure data for several substudies. Although the presentation of the findings in Chapter IV includes for each sub-study a brief review of the instruments used, the present section is presented at this time to afford a summary of the more salient instruments developed for those interested primarily in methodological research.

During the course of the evaluation it became necessary to either translate an existing test or to develop an entirely new instrument. Among the translated tests were The Basic Test of Science Knowledge, which served as a measure of initial science ability and Scale A which consisted of items from two published tests measuring child anxiety (The Children's Manifest Anxiety Scale and the Test Anxiety Scale for Children).* Reviews of these translated tests are amply provided in the substudies in Chapter IV; for this reason they are not described here. It is important for one considering using these translated tests, however, to understand the guiding principles of translation. First, the "Anglicized" version of a scientific term was used in preference to the version preferred by the Dictionary (32) of the Royal Academy. This was done because the students will not have bilingual instruction in their high school science courses; it was considered judicious that the nearest English equivalent of a word be used to effect a smoother transition in the monolingual high school classes. Another guiding principle used in translating was that of sense rather than form, i.e., ideas, not words, were translated. This later principle operated more in the case of sentences than in the case of individual words.

The category of newly developed instruments includes The Cultural Retention Form, The Bilingual Science Tests, and The Personal Data Sheet. The Cultural Retention Form, referred to during the experiment as Scale B, was developed to measure the degree and direction of cultural polarization which students exhibited at the end of the program. The Bilingual Science Tests consisted of three tests serving as criterion measures of science achievement. They were issued at the end of seventh, eighth and ninth grades consecutively. The Personal Data Sheet was developed to provide biographical information and to provide a measurement of student bilingual dominance.

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* Permission for use was granted by Dr. Seymour Sarason, Department of Psychology, Yale University.

Background for Development of Scale B

The end of junior high school usually occurs during a stage of adolescent development characterized by a breaking away from the home; the loosening of home bonds upon the child is measureable to an extent by the child's affinity for other non-home, social groups. Among bilingual children this normal development in adolescence is usually characterized by the less frequent use of the home language. Interviews with teachers of Hispanic-background children indicate that the disuse of the home language is a subtle process initially noticeable in sixth or seventh grade but becoming more overt with each succeeding grade. By graduation, the natural process of adolescent growth and the school's policy of acculturation have served in most cases to negate the home language as a vehicle of communication. It is used only occasionally in selected settings. Similar changes in preferences for styles of dress, modes of behavior and other indicators of culture are also noticeable.

Hispanic-background students demonstrating good achievement and ability in school can cross the bridges of acculturation and adolescence with optimism. A cosmopolitan city with a variety of industry and commerce eagerly anticipates their vocational careers. Acclimated to the language and mores of the host society, these students feel little dependence upon the home as they anticipate a fruitful place in the host society. Hispanic-background students, demonstrating poor achievement and low ability in school however, cannot pass over the bridges of acculturation and adolescence with optimism. Divorced from the resources of the home culture by the natural process of adolescence and the educational policy of the schools, they feel themselves anticipating a future in a host society offering little for the academically unable or untrained. This type of student, cut off from resources of the home culture and without a place in the host society for which he has rejected his home culture, is in a potentially dangerous social state. Whereas a rural environment might reduce social frustration by providing a return to the land, an urban, ghetto environment offers no such surcease.

An aim of the program was to provide for these students in a social "no man's land," an experience in bilingual education, which even if it effected no dramatic changes in academic achievement, would serve to bolster a retention of home culture and a life-line to social identity. To evaluate the degree to which this took place, Scale B was developed.

The Development of Scale B - Cultural Retention Form

The instrument used to measure cultural retention or rejection by the students was the Cultural Retention Form which was referred to during the testing period as "Scale B."

To secure items indicative of cultural retention or rejection, each non-English coordinator and science teacher participating in the study was asked to list on a special form five items indicative of student rejection of Spanish culture and five items indicative of student retention of Spanish culture. Returns received from the nine schools indicated 45 different items proposed by staff members as indicative of cultural retention. Items suggested covered a wide range of student activities, aspirations and habits. They included personal preference items relating to language usage, modes of entertainment and customs regarding food choice and appelation. Items regarding peer relations and group knowledgeability within the culture were reported.

The next step was to have these same schools identify approximately five students who, in staff opinion, were definitely retaining Spanish culture and five, again in staff opinion, who were definitely rejecting the culture. Students selected could not be in either the control or experimental classes. By this means 58 cultural retainers and 40 cultural rejectors were identified. These 107 students formed our pre-test population for determining which of the 45 items best discriminated between cultural retainers and rejectors.

The next step in the instrument development process was to conduct the pre-test. A 45 item version requiring a "Yes" or "No" response was composed and administered in the schools. Student anonymity was preserved and special instructions were devised to secure optimum student participation and reaction. Only code letters identifying students by type were used. Several promising items were excluded from the pre-test form because of their personal nature or potential for negative parent reaction.

Each item was analyzed in terms of the chi-square technique in which the "yes" or "no" responses to the particular item of the cultural retainers and cultural rejectors were compared. The fifteen items appearing in the final form were those best discriminating between student types.

The Development of The Bilingual Science Tests

To test for terminal differences between control and experimental classes at the end of each school year a bilingual science test was developed. Since each of these tests was developed along the same principles of test development, only the test used at the end of seventh grade is here reviewed. It served as a prototype for the development of the bilingual science tests used at the end of eighth and ninth grades.

To insure content validity a content grid was formed listing the objectives of the course in terms of subject matter, skills and related learnings and their corresponding unit areas of chemistry, physics, earth science and biology. From this was determined the number of items in each category required to insure coverage of the course work. For example, an item examining the achievement of a laboratory skill in earth science would appear less important than an item examining an understanding of the nature of an electric circuit in physics. This determination was made by referring to the time allotments suggested for teachers at the head of each lesson in each textbook. If twice as much time was devoted to electric circuits then the test should have, theoretically, twice as many items on electric circuits. By this process the theoretically desirable number of items for each unit in the content grid was determined. In all, the initial or pre-test version of the science test required seventy-four items.

Items for the test were drawn from the textbooks issued to the classes, while other items were devised by two designated experts working in cooperation with the test developer. A pre-test version of the bilingual science test was administered in May, 1965 in three schools having similar seventh grade populations but not included in the study. Returns from the one hundred students tested in the three schools were item analyzed according to the technique of extreme differences. This technique involved stacking all 100 returns in numerical score order from highest to lowest. The top 25% and the bottom 25% of the returns were used for analysis in the conventional manner. The difficulty index and the discriminative index for each item was computed.

Another aspect of the pre-test included teacher opinions of the items. Negative features were listed next to the discriminative and difficulty data previously determined. Results from the pre-test indicated that the test was too difficult with a majority of the difficulty indices below .50. To secure a normal distribution of scores the test was made easier. To do this three factors were considered: First, reduce the number of options for each item response from five to four options; second, secure a better balance of items by omitting the most difficult but including the easier ones; third, readjust item content in terms of amounts of time actually spent in class rather than depending upon amounts suggested for use in the textbook. This latter criticism was brought to the researcher's attention via the teacher criticism sheet. Conferences with the teachers revealed that a major portion of the school year had been devoted to the units on biology, chemistry and physics. Adjustments were made accordingly. A final form of forty items was developed; it was printed in bilingual form in such a manner that when the student opened the text booklet, on his left were the questions and options in Spanish, while on his right were always the same questions and options in English. The aim was to reduce the detrimental influence of language disability and to secure a pure measurement of science achievement. The final form of the test was administered in June, 1966, to the control and experimental classes in each of the sixteen schools.

The Personal Data Sheet

The Personal Data Sheet was developed to provide biographical information concerning the student population and to provide a measurement of student bilingual dominance. It was issued at the beginning of the program and again at the end of the program.

The Personal Data Sheet consisted of three major sections: The first secured biographical information concerning student age, place of birth, years in New York City, and length and location of schooling. The second section consisted of questions designed to measure the degree of bilingual dominance in each child. Students were asked to indicate for each of ten items the frequency with which they used Spanish or English. The third section required that students check one of five statements indicating student attitudes toward science. Bilingual dominance scores were determined from the second section of The Personal Data Sheet.

Determining Bilingual Dominance

In preparing the second section of The Personal Data Sheet to determine the degree of bilingualism in each student, the following guidelines were used.

It was decided to attempt to incorporate into the most unsophisticated appearing format some sophisticated features of test construction. For this reason only a ten item scale within the framework of the guidance setting of The Personal Data Sheet was developed. In developing items the aim was to include within the ten item limit set a variety of media, role, situation and domain type items. The variety of media included within these ten items embraces such linguistic functions as speaking, reading, writing and hearing. The variety of role situations include items in which the respondee is producing, as in speaking, using inner speech, as in reading, or comprehending, as in hearing. The variety of situations included within these items embrace the informal or intimate situations encountered at home, and both the semi-formal and informal situations outside the home. The domains included within these items are the home, the neighborhood and other non-school situations. By having the students indicate the frequency with which they use English or Spanish in such a variety of circumstances, it was felt that an indication of Spanish or English bilingual dominance could be obtained. Variances included within each item are presented below:

ITEM	MEDIA	ROLE	SITUATION	DOMAIN
1.	speaking	production (encoding) ego-source	informal	home
2.	global	all roles	all	non-school; non-home
3.	speaking	production (encoding) ego-source	informal	home
4.	global	all ego roles	all	non-school; non-home
5.	reading	inner speech (decoding) ego-source and target	informal	non-school
6.	writing	production (encoding) ego source	semi-formal	non-school
7.	reading	inner speech (decoding) ego-source and target	informal	non-school
8.	writing	production (encoding) ego-source	semi-formal	non-school
9.	hearing	comprehensive (decoding)	informal and/ or intimate	home
10.	hearing	comprehension (decoding)	informal and/ or intimate	home

Four salient features should be known about the scoring system devised to determine a bilingual dominance score.

First, each item was equally weighted, that is, the same possible maximum and minimum scores could be achieved for any of the ten items.

Second, although there were five possible selections indicating frequency of use of a language for each item, only three numerical values were assigned. This was done for the reasons explained under the section concerning the neutralizing factor.

The following is a description of how numerical scores were assigned, rather than why:

Response to the Item	Language Involved	Score
"Always" or "Mostly"	Spanish usage	"3"
"Always" or "Mostly"	English usage	"1"
"Sometimes"	Either	"2"
"Hardly Ever" or "Never"	Spanish usage	"1"
"Hardly Ever" or "Never"	English usage	"3"

Third, score interpretations are made with the following features as guides.

The maximum possible score was "30"; this score would be indicative of a Spanish monolingual, in that the respondee would have received "3" points for each item concerning frequency of use. In essence he would "always" or "mostly" be using the Spanish language and "never" or "hardly ever" the English language. The minimum score was "10"; this score would indicate an English monolingual, in that the respondee received a "1" score for each item concerning frequency of use. In essence he would "hardly ever" or "never" be using Spanish and "always" or "mostly" be using English. The middle score was "20"; this score would be indicative of a bilingual who was equilingual in that he used Spanish and English with equal frequency in regard to all items. Scores above twenty would be indicative of "Spanish Dominance" in that for all items on the scale the respondee indicates more use of Spanish than English; on the other hand, scores below twenty would be indicative of English dominance. A graphic presentation is presented below:

SPANISH MONO-LINGUAL		EQUI-LINGUAL		ENGLISH MONO-LINGUAL
/30/	/25/	/20/	/15/	/10/
(Spanish Dominance)			(English Dominance)	

The fourth feature of the scoring system concerns the neutralizing factor built in to handle contradictory responses.

A problem encountered in an item arrangement offering five possible responses of usage frequency is invalidity of entries. When testing younger people, especially those not on reading level, the likelihood of imprecise, contradictory responses must be considered.

To offset patently erroneous entries, the scoring system devised presented a neutralizing factor. The following example illustrates its operation.

If in response to the first item the student makes the following selection:

"I use Spanish in speaking at home"

Always Mostly Sometimes Hardly Ever Never
and if in response to the third item the same student makes the following selection:

"I use English in Speaking at home"

Always Mostly Sometimes Hardly Ever Never
there is an obvious contradiction. He cannot possibly be using one language at home "always" and the other "mostly".

The scoring system counteracts for this situation by giving the student a "3" score for the item one response and a "1" score for the item three response. His total score for the two items is four; his average score is two. A two score represents the neutral category in that it does not classify the student as English or Spanish dominant. The student's responses to other items will polarize his total score, rather than these questionable responses.

The rationale for using five options indicating frequency of use, but only three scoring numerals is presented below.

Frequently, when five options are used the scoring range is from 1 to 5. However, this practice is not always desirable because it assumes equal distance between each option, implying a rectangular distribution. Statistical manipulations to offset these situations are not universally established( ). Cognizant of these problems, the following rationale and assumptions were used in constructing the scoring system.

As the population selected was originally bilingual by selective criteria, bilingualism was considered the norm and monolingualism, represented by range scores, the unlikely. A curvilinear rather than a linear distribution was postulated, with the center of the bell-shaped distribution representing the equilingual, bilingual and the ranges representing the monolinguals. The "2" score for an item represented the mid-point of the distribution; the "1" and "3" scores, the extremes of the distribution, but both equidistant from the mispoint.

The question now arises: "If three numbers sufficed for scoring, why then use five options? Why not use only three options indicating frequency of use, such as "Usually", "Sometimes" and "Almost Never?"

Such an approach seemed more consonant with the three numeral scoring system devised. However, there would be situations in which the response would really be "always" (e.g., father's or mother's use of Spanish at home). If only three options were provided, as mentioned above, perhaps an adult could be relied upon to make the mental interpretation indicating an entry in the "Usually"? or "Almost Always" column, but such reliance could not be placed upon what children might do. Too frequently, it was feared, they would omit the item despite any instructions. Failure to present an "Always" or "Never" option would confuse some youngsters and lead to scoring problems, necessitating the loss of many cases. It was, therefore, decided to use five options but only three scoring numerals. The likelihood of the possible misuse of the extreme options such as "Always" or "Never" was considered and prompted the development of the neutralizing factor discussed earlier.

Bilingual dominance scores used in this study were obtained from student responses on The Personal Data Sheet. The scores the students received are conditioned by the rationale and assumptions underlying the development of the instrument.

Administration and Supervision of Program

A longitudinal study design requires the uniform and consistent application or presence of the experimental variable throughout the duration of the study. Normal personnel turnover experienced by large urban schools could create a lack in procedural consistency which in turn could constitute a confounding element in the final evaluation of any experiment. It is therefore important that we detail some of administrative and supervisory procedures which were used in this study in order to minimize or to eliminate the interfering variables introduced by frequent changes in assigned professional personnel.

Each bilingual teacher of science was assisted by a school consultation committee consisting of an assistant principal in charge of science, an assistant principal in charge of foreign languages, a laboratory assistant, a non-English coordinator and the grade guidance counselor. All members of the committee were thoroughly familiar with the aims and procedures involved in the Science-Spanish experiment. The director of the city-wide program met with each committee at least three times a year. These meetings served to establish and reinforce the expected uniform instructional and administrative procedures. The principal of the school was invited to all sessions but could not always attend. All newly assigned teachers received their orientation from the project director as close to the start of their service as possible. An orientation kit which included a statement of the philosophy, and a detailed description of the program was distributed. Sample lessons and tests were provided in order to bring the teacher up-to-date with respect to the progress of her new class. At the start of the program in 1963, a 15 session (2 hour each) course, entitled Methods of Teaching the New Course in Science in the Junior High Schools was given by the director for all science teachers involved in the program. Subsequent to this the director offered an additional course for teachers who were concerned with increasing their fluency in Spanish. Consultation and guidance was immediately available at all times from the central study headquarters.

Direct supervision of the program science teacher was the responsibility of the assistant principal in charge of science. Examination of plan books and classroom observations were followed by periodic teacher-supervisor conferences. Supervision of Spanish instruction was the responsibility of the assistant principal in charge of foreign language. He employed all accepted supervisory techniques used in normal program supervision. The non-English coordinator and the school guidance counselor concerned themselves with pupil admissions, discharges, orientation and counseling. The program was explained to parents by the non-English coordinator and the school principal.

The Office of Foreign Languages of the Board of Education was directly involved in the design and preparation of materials and techniques which were to be used in the newly introduced accelerated course in Spanish. A program modification involving the de-emphasis of the audio-lingual techniques of instruction and a re-emphasis upon formal grammar, rules of pronunciation and contrastive language study was evolved.

A district language supervisor was assigned to each of the experimental schools in order to provide the specialized assistance that could not be given through the regular ladder of supervision because of the innovative aspect of the program. A week-by-week calendar of expected class progress was prepared for each year's work and distributed to the schools. End year examinations to measure the students' progress in Spanish were provided by the Office of Foreign Languages.

The Office of Science Instruction provided guidance in making the necessary adaptions and modifications of the new course of study for use in experimental and control classes. The original low level of English reading ability of all students involved in the study made the normal science sequence particularly difficult. The science office introduced a modified course entitled PATHWAYS for all science groups involved in the experiment. A calendar of expected week-to-week progress was devised and distributed as a guide for all science teachers.

Execution of distinct administrative procedures for a special experiment within a large school system is always difficult because of the inevitable clash with existing rules and policies. The minimizing of these difficulties was achieved through the cooperation of the Office of the Deputy Superintendent of Schools and the different division heads. Several meetings were held in the Office of the Deputy Superintendent at which the cooperation of all division heads and principals was enlisted. Copies of all bulletins and instructional materials were sent to office heads in order to keep supervisory personnel abreast of the program progress.

A central administrative office for the servicing of the experimental schools was maintained at the headquarters of the New York City Bureau of Curriculum Development. The office staff consisted of a director, a research associate, a materials and instructional supervisor, two secretaries and the part-time service of a business and facilities manager.

CHAPTER III

STATEMENT OF RESULTS

1. The Science-Spanish Experiment resulted in superior science achievement for bilingually taught subjects in the seventh grade as measured by tests.

2. The Science-Spanish Experiment resulted in superior science achievement for bilingually taught subjects in the eighth grade as measured by tests.

3. The Science-Spanish Experiment resulted in superior science achievement for bilingually taught subjects in eighth grade as measured by teacher ratings.

4. The Science-Spanish Experiment did not result in a superior pass-fail rate in eighth grade science as measured by teacher ratings.

5. The Science-Spanish Experiment resulted in superior Spanish achievement for experimental students taught Spanish in seventh grade.

6. The Science-Spanish experiment resulted in superior Spanish achievement for experimental students taught Spanish in eighth grade

7. The Science-Spanish Experiment did not result in superior achievement for bilingually taught students in science in the other achievement areas non-bilingually taught.

8. Bilingually taught students who exhibited superiority in bilingually taught science and in Spanish did not exhibit superiority in their other non-bilingually taught major subject areas of social studies and mathematics.

9. The Science-Spanish Experiment resulted in superior ratings for bilingually taught subjects at the end of eighth grade in Effort and Reliability. It did not produce superior results in Conduct of Self-Control, as measured by teacher ratings.

10. The Science-Spanish Experiment results in a greater affinity for Hispanic-culture among subjects bilingually taught.

11. The Science-Spanish Experiment did not result in superior school attendance for subjects bilingually taught.

12. The Science-Spanish Experiment resulted in superior English reading scores for students bilingually taught at the end of eighth grade as measured by city-wide reading tests.

13. The Science-Spanish Experiment did not result in superior English marks for students bilingually taught at the end of eighth grade as measured by teacher report card ratings for English achievement.

14. The Science-Spanish Experiment resulted in a significant decrease in anxiety for the students experimentally taught which did not occur among the controls.

15. The Science-Spanish Experiment resulted in a significant decrease in test anxiety for the students experimentally taught, which did not occur among the controls.

16. The Science-Spanish Experiment resulted in bilingually taught students using Spanish more frequently than comparable controls as measured by the bilingual dominance scale.

17. The Science-Spanish Experiment showed that students of Spanish-speaking background show no significant change in expressed vocational aspiration and expectation after their two years of bilingual study in science.

18. The Science-Spanish Experiment was favorably received by a majority of the staff members involved. It provoked constructive criticism among a minority; dissenters from the majority opinion all agreed the program had some merit. In only one case was rejection total.

19. Examination of the alternate staffing system indicated program success in science is contingent upon staffing with fluent teachers only.

CHAPTER IV

FINDINGS AND DISCUSSION

Seventh Grade Science

During the 1964-1965 school year the project formally began with the introduction of a bilingual innovation in the conventional science program. In sixteen project schools experimental classes were taught science in Spanish; sixteen comparable control classes were taught science in English. A study was planned to compare achievement in science by use of tests and teacher ratings on report cards. This study is confined to an examination of pupil performances as measured by the tests. Pupil performances as rated by teachers on report cards are reported and discussed later.

Hypothesis

The hypothesis examined in this study is:

> "There is no significant difference in mean achievement scores at the end of seventh grade for experimental and control students initially comparable in science knowledge."

The operating assumption underlying this study was that Hispanic-background children with oral ability in Spanish but retarded in English reading would profit more from a science course taught in Spanish than from one taught in the conventional manner. The results are limited not only to population and school types originally defined in the general introduction, but to those students who remained in the school the entire year. Of the 994 students examined in October, 1964 only 661 were present for testing in June, 1965. Results are limited to this population.

Population

The study consisted originally of 994 students in 32 classes of 16 junior high school seventh grades. The students were Hispanic-background, possessed of oral ability in Spanish and on an average retarded two years in English reading ability. Extreme behavioral problems were not included in either the 16 control or 16 experimental classes. The schools were located in the major Spanish-speaking areas of Brooklyn, Manhattan and the Bronx. At the end of seventh grade, however, 661 students were available for testing. The attrition is due to two factors: pupil turnover during the year and absenteeism during one of the two testing periods; however, more of the attrition was due to pupil turnover. Where there were originally 505 experimental students and 488 control students, there were in June 344 experimental and 317 control students. Attrition was about the same for both groups.

Procedures

In October, 1964 a bilingual version of the Basic Test of Science Knowledge was administered to secure an indicator of the students' knowledge of elementary school science. Controls and experimentals were compared for comparability in this trait. At the end of the school year (June, 1965) a bilingual science achievement test was administered to the subjects remaining. Groups remaining were again compared to insure they had been initially comparable; they were then examined for significant mean differences on final scores. In performing the statistical analysis the "t" tests of initial scores were computed without the correlation factor; when computing "t" tests for terminal differences the correlation between tests was used in the analysis.

Analysis and Findings

Table 4 presents the results of the "t" tests comparing experimental and control groups on initial scores received in October, 1964 on the Basic Test of Science Knowledge.

Table 4

Comparative Analysis of Control and Experimental Groups on Initial Scores Received by Students Present for Testing in October, 1964

Group	Number	Mean	Sigma	"t"	P
Experimental	505	35.76	7.30	.40	NS
Control	488	35.57	7.69		

Table 5 presents the results of the "t" tests comparing initial scores of experimental and control students remaining with the school until final testing time in June, 1965.

Table 5

Comparative Analysis of Control and Experimental Groups on Initial Scores for Students with the Program an Entire School Year

Group	Number	Mean	Sigma	"t"	P
Experimental	344	35.52	7.12	.62	NS
Control	317	35.91	7.74		

The data indicate no significant difference between the remaining groups concerning their knowledge of science when the program began. A comparison of the two tables reveals that the groups leaving the schools were substantially the same as the groups remaining. We may infer that had they all remained in the study final results would not have been altered.

Table 6 presents the results of a comparative analysis of remaining experimental and control students in terms of scores they received on The Bilingual Science Test, which was designed to measure seventh grade achievement.

Table 6

Comparative Analysis of Control and Experimental Groups on Final Scores

Group	Number	Mean	Sigma	"t"	P
Experimental	344	20.82	6.92	2.39	Sig.
Control	317	19.72	5.53		
"r"=34					

The data indicate a significant difference between control and experimental students in group mean scores; the difference favors the experimental groups. It is highly unlikely that this difference could be due to chance. We may safely attribute the result to the experimental factor rather than chance.

Conclusions

Hispanic-background students, retarded in English reading ability, profit from a science course taught in Spanish. The null hypothesis is rejected; there is a true difference in science achievement favoring the experimentals. Furthermore, the pupil turnover did not alter the type population remaining for analysis.

Summary

The effectiveness of this program for these students has been demonstrated in seventh grade. However, the magnitude of the difference between group scores, although statistically significant, was not so practically great that definitive conclusions could be drawn. It seemed wiser to await the results at the end of eighth grade. Furthermore, as discussed later under teacher types the significant results were only attained in schools staffed by fluent Spanish-speaking science teachers; no differences were found significant in schools staffed by non-fluent teachers.

Eighth Grade Science

During the 1965-1966 school year the project was continued for those students remaining in the sixteen schools in which the program was inaugurated in the previous school year. Once again a study was planned to measure comparative performances of control and experimental students with regard to achievement in eighth grade science.

Hypothesis

The hypothesis examined in this study is:

> "There is no significant difference in mean science achievement scores at the end of eighth grade for experimental and control students in the project classes."

Assumptions and Limitations

Assumed in this analysis is the hypothesis that the Hawthorne effect was not operative in the seventh grade study. If, again, the experimentals are superior to the controls we can feel this is a program factor independent of the novelty of the experimental experience. The subjects examined had been in the study two years and this should have provided sufficient time for such novelty, if originally present, to have lost luster. The results, however, are limited by the necessity of including as replacements in control and experimental classes, new students to replace those who had transferred. This was necessary to maintain the class sizes. It should be noted, however, that this eventually was foreseen and counselors were alerted in making their replacements to maintain the integrity of the experiment.

Population

The study consists of those students who had been in the program for seventh and eighth grades; the replacements who had been in the program for only eighth grade were excluded. The numbers constituting replacements were substantially the same for both groups with a slightly greater degree of frequency among controls. Furthermore, the type student replaced was usually substituted by a similar student of Hispanic-background meeting the original criteria for selection. However, where this could not be done the student remained in the class but was eliminated from consideration in the analysis. Again, inadequate replacements occurred more frequently in the control than in the experimental classes. In only two of the sixteen schools did this occurrence of large groups of improper substitutes occur; these schools alerted the staff of the situation and elimination of improper types occurred. Furthermore, the population available for analysis consisted of those students who were present for the final test. A slight diminution of population occurs for this reason. In essence this study is restricted to those control and experimental students who had been in the program two years; there were 182 experimental and 140 control students available for analysis.

Procedures

The scores from Bilingual Science Test II were recorded on special Digitek Answer Sheets. These sheets were then scored by the optical scanner. Frequency distributions were made for those experimental and control students eligible for this analysis in terms of the population defined. There were 322 students so available.

Analysis and Findings

The following table presents the results of the "t" test for mean differences between the 182 experimental and 140 control students who had been in the program two years.

Table 7

Comparative Analysis of Control and Experimental Students in the Program Two Years at the End of Eighth Grade

Group	Number	Mean	Sigma	"t"	P
Experimental	182	19.31	7.22	4.5	Sig.
Control	140	16.08	5.82		

The table indicates that the experimental group was different from the control group to a highly significant degree. The group mean difference of 3.23 score points if favorable to the experimentals.

Conclusion

The null hypothesis is rejected: the experimentals are significantly different from the controls.

Interpretation

The project continued to have the same positive effect upon experimental groups in eighth grade that it had in seventh grade. In fact, the magnitude of the mean difference is much greater this grade than last, although both were significant. These findings reinforce the inference that a bilingual program such as this results in superior student science achievement.

Eighth Grade Report Card Science Marks

The two previous studies examined comparative student performance in science achievement as measured by tests. This study examines comparative student performance in science achievement as rated by teachers on report cards. The purpose of the study was to determine whether or not the findings in terms of teacher ratings on report cards would duplicate the findings in terms of tests.

Hypotheses

Because the comparisons are made in terms of total scores and, again, in terms of numbers passing and failing, two hypotheses were examined:

1) There is no significant difference between mean science report card ratings of control and experimental eighth grade students.

2) There is no significant relationship between classification as a control or experimental student and the numbers passing and failing on report card science ratings.

Assumptions and Limitations

Two possible limiting factors should be considered in interpreting the results. First, the control and experimental classes in eighth grade were not taught in each school by the same teacher in science. Teacher turnover and programming difficulties accounted for this; where such a situation occurred, however, the administrator saw to it that comparable teachers taught each class. Nevertheless, variability due to differences in teachers must be assumed in the report card ratings. This variability was anticipated and assumed accounted for by the large number of teacher raters involved. It was assumed that among the 14 teachers rating experimental students and among the 14 teachers rating control students there would be an equivalent frequency of various types of teacher raters. Second, the study was conducted with eighth grade classes composed of some students who had been in the program two years and some who had been in the program one year. Student turnover accounted for the necessity of replacements in eighth grade. The number of one and two year students, however, is not radically different for the control and experimental groups.

Population

The subjects examined in this study came from experimental and control classes in ten of the fourteen schools. Twenty classes comprising 530 students participated in this study; there were ten experimental classes of 265 students and ten control classes of 265 students. The teachers entering marks for the experimental and control classes were the same in some schools but different in most schools.

Instruments

Final marks as recorded on Permanent Record Cards by teachers at the end of eighth grade were transferred to a Pupil Profile Sheet and mailed to the research staff.

Definitions

Achievement: In this study the term refers to total classroom pupil performance in a subject area. The term encompasses all those aspects of pupil growth considered by a teacher in determining a student's final mark. Such aspects as knowledge of subject matter, pupil participation, performance on homework assignments, quality of projects or reports, etc., are usually determinants of the teacher's judgment. The term used here is to be distinguished from the term "achievement" as measured by standardized tests which focus more upon knowledge of subject matter and mastery of pertinent skills. Achievement as used in this section of the evaluation is a global concept encompassing many factors relating to the student's performance in the course of a year's work in class.

Procedures

Science marks entered by teachers on the school Permanent Record Card at the end of eighth grade were transcribed by the Non-English Coordinator to the Pupil Profile Sheet. Marks used in this study were taken from these sheets. Although the usual system in giving students marks is to assign them in multiples of five, this was not always the case; the range of ratings was from a low of 20 to a high of 100. Only the fourth quarter marks were used in this study.

From the Pupil Profile Sheets returned it was noted, as anticipated, that some students had been in the program only one year. The decision to retain them in the study was based upon three factors: first, desireability of a large population; second, our finding regarding seventh grade science, notably, that if a significant achievement difference occurs it will occur within one year of exposure to bilingual education; third, the balanced number of one and two year students in most experimental and control classes.

Mean achievement grades were compared for both groups. Conventional "t" tests for uncorrelated groups were used. In examining the "Pass-Fail" categories, however, the chi-square technique was used.

Findings are presented in terms of each subject area examined.

Table 8

A Comparative Analysis of Mean Differences Between Control and Experimental Classes on Fourth Quarter Report Card Marks in Science

	Number	Mean	Sigma	Mean Diff.	"t"	P
Experimental Students Taught Science in Spanish	265	74.49	12	2.90	2.78	.01
Control Students Taught in Conventional Manner	265	71.59	12			

The table reveals that experimental students taught science in Spanish were different in terms of mean score from the control students taught in the conventional manner to a statistically significant degree. Variability was almost identical.

Conclusions

The null hypothesis is rejected. There is a significant difference between control and experimental students in terms of group mean science report-card marks received at the end of the eighth grade.

Table 9 presents the data and results of the study of the same students concerning the numbers passed and failed. Specifically, it was intended to determine if the experimental pass-fail rate differed significantly from that of the controls. Once again, some marks were used for the same pupils as reported in the last table.

Table 9

Chi-square of Experimental and Control Students Passing and Failing Science

	Experimental	Control	X^2 Value	P
Number Passed	226	216	.001	NS
Number Failed	39	49		

The table indicates that although more control students failed than did experimental students, this result is probably due to chance. The apparent superior number of passing students of the experimental type is not a real factor attributable to the experiment.

Conclusions

The null hypothesis is accepted. There is no significant relationship between classification of students as control or experimental and whether or not they pass science.

Summary

In comparing control and experimental students concerning science achievement as rated by subject teachers, it was found that the experimental students were definitely superior to the control students. However, when the pass-fail rate of both groups was compared there was no significant difference. In effect it has been found that when bilingual students are taught science in Spanish they will on an average exhibit a higher average mark on report cards than those comparable students conventially taught. The number of students, however, who pass or fail the subject will not be substantially changed. The Science-Spanish Project, then, is most positively operative along the entire range of student marks rather than in getting more students over the passmarks.

First Year Spanish

One aspect of the experimental design provided that the bilingual experimental students receive instruction in Spanish. Ordinarily, these children would not have been permitted to take such a course because their English Reading Grades, a selective factor in determining participants, were too low. It was assumed, however, that these children should receive instruction in Spanish for two reasons: first, it would aid in their bilingual science class work; second, regarding the Spanish language class, their advantage in having an audio-lingual knowledge of Spanish might outweigh their disadvantage in English reading ability.

Hypothesis

"There is no significant difference between average Spanish marks of control and experimental students in seventh grade Spanish."

Assumptions and Limitations

If the experimental groups do as well as or superior to the controls the Science-Spanish Program during seventh grade had a positive effect. This is assumed related to the effect of the Science-Spanish Program because it (a) permitted Hispanic-background children with some speaking ability in Spanish and who ordinarily would not have been permitted to take Spanish to participate in a Spanish language course, and (b) it allowed the use of Spanish in all phases of science class work.

In this particular study the ordinary control classes could not be used because those children were receiving the conventional program which excluded them from taking Spanish because of low English Reading Scores. As detailed later in the Definitions, the special controls used for this study consisted of students who were superior students to the experimentals by ordinary selective criteria. It is assumed, therefore, that in this study the experimentals were not initially comparable to the controls but were handicapped.

Definitions

Special Control Classes: These classes were comprised of Non-Special Progress, but Academic ninth grade students who would ordinarily take a foreign language in junior high school. They are permitted to take Spanish as a foreign language because they were on or above reading grade level in English. They study Spanish five periods per week and receive credit upon passing at the end of the term for Level I Spanish.

Experimental: These classes were composed of seventh grade students who were in the bilingual experimental classes. They were on an average about two years retarded in English reading. They would not have ordinarily been selected for learning a foreign language. They were also less mature than the control group, in that they were seventh graders while the controls were ninth graders. Although handicapped in age and English reading ability, they had the advantage of an audio-lingual knowledge of the language.

Population

Participants came from eleven of the sixteen schools having the program in seventh grade. Five schools had to be omitted because of factors in test administration which would have favored one group or the other. In some cases data was insufficient, incorrect or missing. The schools in our study, however, represent all three boroughs and constitute a 68% sample of all seventeen schools. There were 281 experimental students and 297 control students available for analysis.

Procedures

Both the experimental and special control classes participated in classes teaching Spanish as a foreign language. At the end of the school year all participants were given the 1954 Spanish City-wide, Level II examination. This examination was administered in June, 1965. Marks were recorded on special forms by the teachers and forwarded to research. The data were scanned for invalid or unreliable entries. The results for each group were compared by the conventional "t" test.

Findings

Table presents the results of the "t" test for average scores received by the experimentals and special controls on the Spanish test administered.

Table 10

Results of "t" Test for Control and Experimental Students on the 1954 Spanish City-Wide, Level II Examination Given June, 1966

	Mean	Sigma	Number	"t"	P
Experimental	74.42	4.11	281	2.17	.05 - .01 (Sig.)
Control	73.66	4.30	297		

The table indicates that the experimental students differed significantly from the controls; the difference favored the experimentals. The result is more likely a factor of superior performance on the part of the experimentals than it is due to chance.

Conclusion

The null hypothesis is rejected. The experimental students are different from the control students to a statistically significant degree in terms of marks received on the city-wide test in Spanish.

Interpretation

The experimental students did not only do as well as the controls but better. When we remember that the experimentals were retarded at least two years in reading and the controls were the more advanced students in junior high school selected from the brighter groups, we begin to realize the significance of this finding. The initial gap between the two groups handicapped the experimentals. However, this was counter-balanced by their audio-lingual knowledge of language, use of it in science and study of it in Spanish classes.

Second Year Junior High School Spanish

By June, 1966, the experimental students remaining in program had completed another year of learning Spanish as a foreign language. At this time there were fourteen schools remaining in the program, but due to school-grade reorganization of the city school system nine schools were terminating the program at the end of the second year; the remaining five schools continued the program into the ninth grade. These latter five schools are reserved for the Three Year Study and were not participants in the Two Year report concerning Spanish. In effect nine schools were available for this study.

Hypothesis

> "There is no significant difference between mean scores achieved in Spanish by experimental class students and special controls."

Similarities and Differences

For the sake of brevity the similarities between this study and that reported previously under the heading First Year Spanish are not repeated in detail. The purpose of this study, its definitions, procedures, assumptions and limitations are similar to those of the First Year Spanish Study.

This study, however, differs from the previous study of Spanish achievement in two areas. First, the terminal instrument administered for criterion scores was a city-wide Level II Spanish examination instead of the Level I examination. This was a natural educational consequence of the fact that the students had now completed two years of Spanish and needed a more advanced measure. Second, the population used in this study is a sample of the schools leaving the program at the end of the second year. Where the parameter for the first year study consisted of fourteen schools from which samples could be drawn, only nine schools were used as the parameter for this second year study. This decision was made because of the heavy testing burden the schools were experiencing. To alleviate this problem all Three Year Study schools were eliminated from the parameter. Then, a fifty percent sample of the Two Year Study Schools were included. In effect, of the nine Two Year Study Schools available for testing, five schools, approximately half, were sampled for data. Borough representation was the key determinant.

Findings

Table 11 indicates the results of the "t" test comparing final marks on the Level II, City-wide Spanish examination given in the junior high schools in May, 1966.

Table 11

Comparative Analysis of Experimental and Control Mean Spanish Scores

	Number	Mean	Sigma	"t"	P
Experimental	114	79.40	12.2	.93	NS
Control	122	81.20	17.3		

The table indicates that the special control classes scored slightly higher on an average than the experimental classes; this difference, however, is probably a factor of chance as the "t" value of .93 is not significant. The table also indicates that the controls were much more variable than the experimentals, that is, the experimentals tended to cluster about the mean score while the controls tended to receive scores much lower and higher than the experimentals. The essential fact, however, is that no real difference between mean score exists; the experimentals do as well as the controls.

Conclusion

The null hypothesis is accepted; no real difference was found between mean Spanish scores for controls and experimentals.

Summary

After two years in the program the bilingual experimental students are still doing as well as the control students on average Spanish score. The superiority of the experimentals over the controls, which was found at the end of the seventh year, did not occur in the eighth year. The controls have caught up to experimental performance. Nevertheless, the results must still be interpreted as a positive gain for the program because of the handicap the experimentals had initially.

English Progress

Whether a bilingual education would have a positive, negative or neutral effect upon a child's growth in English was a debatable point at the inception of the study. Although the study aimed to improve English ability among those students receiving bilingual science instruction, misgivings were expressed indicating that such participation would polarize the children toward Spanish usage and impair their growth in English. To examine these theories two studies of English achievement were made for The Two Year Study. The first study examined participants' scores on standardized reading tests; the second study examined participants' report card ratings by classroom English teachers. The former study sought to provide information independent of the teachers' evaluations and limited to the area of reading achievement; the latter study sought to investigate teacher judgments concerning the more inclusive area of classroom English achievement.

The Study of Standardized Test Results in English

Hypothesis

The hypothesis examined in this investigation was expressed in null form indicating a neutral effect of bilingual education upon the participants:

> "There is no significant difference between mean scores achieved by comparable experimental and control students on eighth grade English reading scores received on standardized tests."

Assumptions and Limitations

It is recognized that a standardized test of English reading ability tests only one area of language use and, as in this case, measures only two aspects of the area of English reading: word knowledge and reading comprehension. Such aspects as oral and aural ability, writing, creative expression, etc. are not included within this investigation. It is assumed, however, that there is a generally positive relationship between the aspect measured herein and other aspects of English language usage. Although this is generally recognized for the normal English-speaking population, it has not been proved for bilinguals and is therefore stated as an assumption.

Population

The subjects examined in this study came from experimental and control classes in 80% of the ten schools in the Two Year Study. From these eight schools only students who had been in the program the entire two years, and only students whose original English reading scores in sixth grade ranged from 4.0 to 5.9 were included in the study. In all, 278 students were suitable subjects for this study.

Instruments

Scores used as data in this study were from the Metropolitan Reading Test (Intermediate Level) given on a city-wide basis in the Elementary Schools in January of 1964, while the students were in the sixth grade, and the Metropolitan Reading Test (Advanced Level) given on a city-wide basis in April of 1966, while students were in the eighth grade.

Definitions

Ability in English - as used in this study the term refers to English reading ability as measurad by the Metropolitan Tests and expressed as average scores of reading comprehension and vocabulary parts.

Procedures

Subjects selected for the study were selected from schools leaving the program at the end of two years. They had been present for both tests and had scores entered on their Pupil Profile Sheets. Furthermore, their original scores were within the 4.0 to 5.9 range.

From the experimental classes 145 students were available; from the control classes, 133 students. The sixth grade reading scores were studies for comparability in terms of mean scores. The eighth grade reading scores were tested for differences in mean. Conventional "t" tests for uncorrelated groups were used in both cases.

Analysis and Findings

Table 12 summarizes the pertinent data and findings concerning the hypothesis examined in this study.

Table 12

Comparison of Mean Differences in Scores Achieved by Experimental and Control Students While in the 6th Grade, and again, in the 8th Grade

		Initial (6th)			Final (8th)		
	Number	Mean	Sigma	"t"	Mean	Sigma	"t"
Experimental Students (Bilingual Instruction)	145	4.93	.49	1.7	6.78	1.2	2.9*
Control Students (Conventional Instruction)	133	4.83	.48		6.38	1.17	

* = significant

Table 12 indicates that the groups were initially comparable in English reading ability as measured by the Metropolitan Reading Test given in the 6th grade of January, 1964. At that time they should have been reading on a 6.5 level; the table indicates that the control and experimental groups were then reading below grade level approximately one year and six months. The data indicate that students retarded in reading form the bulk of this population, thereby, verifying our selection procedure which excluded all with reading grades above 5.9 or below 4.0. Initially, the control and experimental groups differed in mean reading score by one school month; this difference is, however, probably due to chance. The high "t" value of 1.7 is not significant.

The table further indicates that after two years of participation in the experiment a statistically significant difference occurred between experimental and control reading scores for the same pupils. When tested in April of 1966, the experimental group was reading on the 6.78 level while the control group was reading on the 6.38 level. This difference of four months was found to be statistically significant, as the "t" value of 2.9 indicates. At the time of testing, April of 1966, groups should have been reading on the 8.10 level. The experimentals were on an average, reading one year and four months below grade level, while the controls were one year and seven months below grade level.

Although both groups were still over a year below reading grade level, neither group was as much below reading grade level as initially, when both were approximately averaging one year and nine months reading retardation. This favorable development is due to the general school wide factors operating in both control and experimental classes. The four month difference, however, between control and experimental reading grade scores at final testing indicated there was a difference favorable to the experimentals which can be attributable to the experimental factor.

Conclusions

The null hypothesis is rejected; there is a significant difference between mean scores achieved by comparable experimental and control students on eighth grade reading scores. The comparison of scores from the 6th grade test indicates the groups were alike initially; however, it must be remembered that we have been dealing here with a restricted range as indicated by the nearly identical standard deviations. This is a result of the purposive selection to include only those with scores from 4.0 to 5.9. The comparison of scores from the 8th grade reading test, after the experimental students had been exposed for two years to bilingual education, indicated that the experimentals were different from the controls in terms of English reading ability; the difference favored the experimentals. Had a correlated mean difference test been used, it would only have served in analyzing the findings to increase the already significant "t" result. The degree of difference would have been based upon an "r" made spurious by the fact that a range restriction existed in initial measures. Nevertheless, the conclusion may safely be drawn that a favorable difference for the experimental groups existed at the .01 level of significance.

Interpretation

Although there is a statistically significant difference favoring the experimentals the practical significance of the difference is open to subjective judgment. To some, the difference of four months might be considered practically significant; to others, the difference might not be so considered, since the actual difference between the groups (4 months) is less than one term of education. Furthermore, analysis of the variance attributable to difference among participating schools indicated school differences were factors which would reduce the applicability of the results.

Rather than claim that bilingual education will improve English reading ability, a conservative interpretation is made: bilingual education will neither impair nor injure sample children's ability to progress in English reading ability. As results show, it could very well improve such ability in some cases.

Although an argument can be made for an interpretation advocating bilingual instruction as a means of improving English (possibly due to transference effects), the study has definitely found that bilingual education does not have a negative effect upon children's English reading ability.

The Study of Report Card Ratings in English

Hypothesis

The hypothesis examined in this investigation was:

> "There is no significant mean difference between control and experimental English marks as recorded by classroom teachers during the final marking period at the end of eighth grade."

Assumptions and Limitations

This study uses data entered by teachers on report cards. It is assumed that the report card rating at the end of eighth grade is a valid indication of school achievement. It is further assumed that in examining the report card ratings a more global aspect of school English achievement is under investigation than that provided by the standardized test scores of English reading ability. It is further assumed that randomization has accounted for initial group comparability.

Population

The subjects examined in this study consisted of 242 experimental students and 241 control students. The total number of 483 students participating in this analysis is greater than the total number of 278 students participating in the study of English reading ability scores primarily because this study includes all eighth grade students. Whereas the study of English reading ability from standardized test scores was confined to students who had been in the program two years and whose initial scores fell between 4.0 and 5.9, this study includes all students who were in the program for two years or less. Therefore a great many student replacements for original students transferring in eighth grade are included in this population. In essence this population differs from the previous population in two respects: first, they were in the program for one and two years; second, they were not restricted according to initial reading score, whereas the other study restricted the acceptable range for inclusion in the study. Both these factors account for the larger number of students.

The teachers entering marks were not the same for each control and experimental class. At this time many teachers had transferred or undergone program changes so that in more than half the cases the experimental and control classes were not taught by the same teachers. An attempt to control teacher variability was made by including many schools. It is expected that this range of schools will make equivalent the varieties of teacher marking differences.

Instruments

Teacher report card ratings for the final marking period were entered by the staff upon the Pupil Profile Sheet and submitted for analysis. The final marking period for the eighth grade occurred during June, 1966.

Procedures

Descriptive statistics of central tendency and of dispersion were computed for the control and experimental groups from the data provided on the Pupil Profile Sheet. Scores were then analyzed for comparative mean difference by means of the "t" test for uncorrelated means.

Analysis and Findings

Table 13 presents the results of the analysis in terms of final report card ratings according to comparative mean differences.

Table 13

Comparative Analysis of Control and Experimental Mean Report Card Ratings in English at the End of the Final Marking Period

	Number	Mean	Sigma	"t"	P
Experimental	242	71.18	10.7	.71	NS
Control	241	70.47	11.2		

The data indicate that at the end of eighth grade the experimental and control groups differed by less than one point in mean report card rating. As the "t" of .71 indicates this difference is probably due to chance. In essence, there is no significant difference between controls and experimentals regarding English classroom achievement as rated by teachers.

Conclusion

The null hypothesis is accepted; there is no significant difference between control and experimental groups in classroom English achievement as rated on end term report cards by teachers.

Summary

Two studies were conducted to investigate the effects of bilingual instruction upon students ability in English. The first study concerned reading achievement as measured by standardized tests; the second study concerned classroom achievement in English as measured by teacher ratings on report cards at the end of eighth grade. The studies sought to determine whether bilingual instruction had a positive, negative or neutral effect upon students' ability in English.

The study of English reading scores demonstrated that for comparable control and experimental groups there was a significant difference favoring the experimentals. The study of English achievement as measured by teacher report card ratings showed there was no significant difference between control and experimental groups. In the former study, bilingual instruction had a positive effect upon the experimental students; in the latter study bilingual instruction had a neutral effect upon the students.

Any interpretation of these results would indicate that bilingual instruction does not have a negative effect upon student English in terms of the dimensions investigated. Debatable, however, is whether the effect of bilingual instruction is positive or neutral. The study of English reading scores would indicate a positive effect; this conclusion, however, is questionable if one deems a fourth month reading score difference as insufficient to constitute a practical difference. The study of English classroom achievement would indicate a neutral effect; this conclusion, however, is questionable if one remembers that the populations included students in the program for one and two years, whereas the other study was confined to a two year group.

At this juncture the soundest acceptable conclusion would seem to be: Bilingual instruction does not have a negative effect upon student's classroom achievement in English nor upon their standardized reading tests; indications are, however, that it might very well have a positive effect upon student's achievement in English as evidenced by a rise in standardized reading scores.

Other Achievement Areas: Social Studies and Mathematics

An examination of the experimental effect upon two other major achievment areas was made by comparing control and experimental classes in terms of teacher marks given in the major subjects of mathematics and social studies. Although the program did not directly aim at improving achievement in any area other than science, it was felt that the possible positive or negative effects of bilingual science education upon other major achievement areas should be investigated.

Hypotheses

Because the comparisons were made in terms of average scores and, again, in terms of numbers passing and failing, two hypotheses were examined for each subject area:

1) There is no significant mean difference between control and experimental scores given by teachers of the subject area considered.

2) There is no significant difference between control and experimental students in terms of numbers passing and failing each of the subject areas considered.

Assumptions and Limitations

It was assumed that a halo effect might have been operative in this experiment; that is, a positive effect upon experimental students' science achievement might result in a positive effect upon other cognitive areas. The results obtained are limited by three factors which should be considered in interpreting the results: first, control and experimental classes were not taught in each school by the same teachers in every subject. There is variability due to differences in teacher rating interpretations. This defect, however, is assumed accounted for and remedied by taking a large number of classes into consideration. The aim, thereby, was to include among those rating both experimental and control classes the complete range of teacher marking interpretations. Second, the study was conducted with eighth grade classes comprised of some students who had been in the program one year and some in two years. To have restricted the study to just those in for two years would not have given the broad sample desired. Third, since subjects were originally assigned randomly and since our previous substudies indicated no initial group differences, analysis was confined to terminal scores.

Population

The subjects examined in this study came from experimental and control classes in the nine Two Year schools. Eighteen classes comprising 530 students were subject to examination; there were approximately 265 control students and 265 experimental students available for each study. The teachers entering marks for the experimental and control classes were the same in some schools but unlike in most schools.

All students who had been in the eighth grade were included in the study. The decision to include both those who had been in the program one year and those who had been in for both the seventh and eighth grades was based upon three factors: first, desirability of a large population; second, our finding last year that if a significant achievement difference occurs it will occur within one year of exposure to bilingual education; third, the balanced number of one and two year students in most experimental and control classes.

Instruments

Final marks as recorded on Permanent Record Cards by teachers were transferred to Pupil Profile Sheets and mailed to the office. One part of the Pupil Profile Sheet contained a section for recording marks received by control and experimental students in English, social studies, science and mathematics.

Definitions

Achievement - as used in this study the term refers to total classroom pupil performance in a subject area. The term encompasses all those aspects of pupil growth considered by a teacher in determining a student's final mark. Such aspects as knowledge of subject matter, pupil participation, performance on homework assignments, quality of projects or reports, etc., are usually determiners of the teacher's judgment. The term used here is to be distinguished from the term "achievement" as measured by standardized tests which focus more upon knowledge of subject matter and mastery of pertinent skills. Achievement as used in this section of the evaluation is a global concept encompassing many factors relating to the student's performance in the course of a year's work in class.

Procedures

To secure the data for examination, a Pupil Profile Sheet was developed on which information concerning the students personal and social development, school achievement, biographical information and standardized test scores was entered. Marks used in this study were taken from these sheets. Only the final fourth quarter marks were used in this study.

From the experimental classes approximately 265 students were available with the number varying from one subject to another; the same situation and number existed for the control classes. Mean achievement grades were compared for both groups. Conventional "t" tests for uncorrelated groups were used. However, in examining the "Pass-Fail" categories, the chi-square technique was used.

The Findings Concerning Social Studies

It was sought to determine whether student achievement in social studies had been indirectly affected by the experimental factor. Two hypotheses here examined: the first related to differences between control and experimental students in terms of average grades; the second related to the same students in terms of numbers passing and failing.

Table 14

Comparative Analysis of Mean Differences between Control and Experimental Classes in Fourth Quarter Report Card Marks in Social Studies

	Number	Mean	Sigma	Mean Diff.	"t"	P
Experimental Students (Bilingual Education)	266	70.04	10.5	1.60	1.61	NS
Control Students (Conventional Education)	257	68.39	12.1			

The table indicates that although the mean score of the 266 experimental students was higher than that of the 257 control students, the mean difference is a factor of chance and not due to some other factor.

Conclusions

The null hypothesis is accepted. There is no significant difference between group mean scores in terms of Social Studies marks received at the end of eighth grade.

Table 15 presents data concerning the same students categorized according to the numbers passed and failed. Specifically, it was intended to determine if the experimental pass-fail rate had been different from that of the controls. The same marks were used for the same pupils but they were treated categorically.

Table 15

Chi-square of Experimental and Control Students Passing and Failing Social Studies

	Experimental	Control	X^2 Value	P
Number Passed	246	225	3.62	NS
Number Failed	20	32		

The table indicates that although more control students failed then experimental students, this result is probably due to chance. The groups cannot be defined as truly different in terms of passing and failing social studies.

Conclusions

The null hypothesis is accepted. There is no significant relationship between categorization as an experimental or a control student and whether or not a student passes or fails. The groups are not different in this aspect concerning social studies achievement.

Summary

In comparing control and experimental classes concerning social studies achievement as rated by subject teacher, no differences were found either in terms of average marks or in terms of passing and failing. Positive effects of bilingual education in other areas were not transferred to social studies achievement as rated by subject teachers in terms of marks.

The next major subject area examined was mathematics. Again, the purpose was to determine if the experimental factor had a related positive effect in this achievement area. Again, scores were examined in terms of averages and in terms of pass-fail categories.

Table 16

Comparative Analysis of Mean Differences Between Control and Experimental Classes on Fourth Quarter Report Card Marks in Mathematics

	Number	Mean	Sigma	Mean Diff.	"t"	P
Experimental Students	260	74.38	9.85	.83	.82	NS
Control Students	262	75.21	12.80			

The table indicates that although the mean score of the control students is slightly higher than that of the experimental students, the mean difference is due to chance rather than to any educational factor. As in the cases of English and social studies the control students were more variable in marks received, but not to any significantly effective extent.

Table 17 presents the data concerning the same student marks categorized as students passed and failed. Specifically, it was intended to determine if the experimental pass-fail rate differed significantly from that of the controls. Once again, same marks were used for the same pupils reported in the previous table.

Table 17

Chi-square of Control and Experimental Students Passing and Failing Mathematics

	Experimental	Control	X^2Value	P
Number Passed	228	229	.099	NS
Number Failed	32	33		

The table indicates that although more control students failed than experimental, this result is most likely due to chance. The almost imperceptible difference between group categories explains the low chi-square value.

Conclusion

The null hypothesis is accepted. There is no significant relationship between classification of students as control or experimental and whether or not they pass mathematics.

Summary

In comparing control and experimental classes concerning mathematics achievement as rated by subject teachers, no differences were found either in terms of average marks or in terms of passing and failing. Positive effects of bilingual education in other areas were not transferred to mathematics achievement as rated by subject teachers in terms of marks.

Anxiety Study

An earlier study by Spoerl(37) found more maladjustment among bilingual children than among monoglots. In reviewing this study Anastasi (1) commented that

> "Such maladjustment seemed to result chiefly from the culture conflict experienced by members of the 'second generation'... Their bilingualism tended to make the maladjustment more acute, since it served as a symbol of the conflict"

This culture conflict as observed by others seems to be characterized by overt actions indicative of the degree to which the bilingual considers the home as a social asset or liability. Others in the field of psycholinguistics feel that for many bilingual children rejection of the old language is correlated with rejection of the home. Sarason (36) found that overanxious children tend to be characterized by a lack of communication with parents about school experiences. If a lack of communication with the home is highly related to overanxiety among children, and if the bilingual child tends to sever relations with his bilingual home (more so than in the case of a monolingual child in a monoglot home) perhaps anxiety occurs more among bilingual children. However, if the bond between home and bilingual child can be increased then the anxiety experienced by the child might be expected to diminish. By using the language of the home as the language of instruction, the bond between home and bilingual child should be strengthened since the parents will, with their superior knowledge and versatility in the parent language, become assets in the child's eyes. Furthermore, in using the parent as a resource the child will bring home school experiences. Consequently, again a decrease in anxiety is hypothesized.

In addition to the psychological research indicating the fruitfulness of a study in this area, attitudes among schoolmen indicated the desirability of an anxiety study. In organizing the experimental and control classes, the children were necessarily grouped into homogeneous classes at least during their science and Spanish classes. Furthermore, the mechanics of school programming and the exigencies of school life would probably result in the block programming of these children in at least one other period and perhaps more. It was feared this inadvertent isolation would be reflected in more uneasiness among the children. For these reasons the suggestion of our consultant to include a study of children's anxiety was accepted.

Hypothesis

The question under investigation in this study was: "Do students exposed to bilingual education experience positive or negative change in terms of general anxiety?" the hypothesis examined is:

> "There is no significant difference between control and experimental mean anxiety scores received at initial and final testing."

Assumptions and Limitations

Although the direction of the effect of bilingual education upon child anxiety is not known, it is assumed that the effect will be anything but neutral. Such an assumption justifies conducting this study. A decrease in anxiety among experimentals is assumed to be indicative of improvement. Furthermore, the study is limited to those students who were in the program for two years.

Population

The subjects examined in this study came from experimental and control classes in nine of the ten schools in the Two Year Study. From these nine schools only students who had been in the program the entire two years and had both initial and final scores were included. In all, 198 students were available for analysis: 121 experimental and 97 control.

Instruments

Scores used in the statistical computations came from "Scale A." "Scale A" was devised to include a bilingual edition of two standard anxiety tests: The Children's Manifest Anxiety Scale and The Test Anxiety Scale for Children. The former test consisted of 53 items of which eleven items constituted the "L" scale and the remaining 42 constituted the "A" scale. Only the 42 items of the "A" scale were considered in forming total scores. This system of scoring was used because the authors of the tests had not decided upon the most reliable and valid means of adjusting the "A" score in terms of the "L" score. Also, for this reason the test was referred to as "Scale A." The second part of the instrument used in this study consisted of the last twelve items from the Test Anxiety Scale for Children. In essence the instrument used in this study consisted of the 42 "A" items from the general anxiety scale and the 12 items from the test anxiety scale, making for a 54 item test. However, in this study only the results of the first 42 items are analyzed. A separate report will be made on the 12 items of the test anxiety scale.

Procedures

At the commencement of the study in 1964 Scale A had been administered. Two years later, in June of 1966, Scale A was re-administered while the students were in the eighth grade. Student answers were entered upon Digitek Scoring sheets which were then marked by the optical scanning machine.

Two separate analyses were conducted. The first examined control and experimental groups concerning initial and final mean differences. In this analysis the uncorrelated "t" test was used. The second analysis examined experimental and control groups for mean changes between initial and final testing. In this analysis the correlated "t" test was used.

Analysis and Findings

Table 18 presents results of both testings for both groups. It should be noted that initially the groups were not alike. The mean anxiety score of 23.01 received by the experimentals is significantly higher than that of 19.54 received by the controls as verified by the significant "t" value of 3.37. This difference between groups in terms of initial scores is probably a result of losing students during the two year period. Analysis of all initial anxiety scores indicated that the groups were originally similar. Of the groups remaining for analysis, however, the experimentals were initially a more anxiety beset group.

A review of the table indicates, however, that at the time of final testing the controls and experimentals were alike. The mean difference of 1.60 is probably due to chance as the insignificant "t" value of 1.30 indicates.

These findings indicate that although the experimentals were initially a more anxiety beset group after two years in the program they were no different from the controls in terms of anxiety. The inference is that the experimentals decreased in anxiety much more than the controls. To check this implication another analysis of changes in mean score was conducted.

The table indicates that originally the experimental average anxiety score was 23.01; at the time of final testing, however, it had decreased to 20.02. Analysis of this decrease indicated that the decrease was significant as indicated by the "t" value of 2.99. The decrease, then, may be termed a real one rather than a chance factor in the case of the experimentals.

Table 18

Comparison of Initial and Final Anxiety Scores on the Scale "A" Tests for Two Year Experimental and Control Students

		Initial Scores		Final Scores				
	No.	Mean	Sigma	Mean	Sigma	M-diff.	"t"	P
Experimental	121	23.01	7.46	20.02	9.35	2.99	3.99	Sig.
Control	97	19.54	7.75	18.42	8.45	1.12	1.42	NS
Mean Difference		3.47		1.60				
"t" of the Difference		3.37		1.30				
P of the Difference		Sig.		NS				

The table indicates, furthermore, that in the case of the controls the mean difference of 1.12 between the initial mean score 19.54 and the final mean score of 18.42 is not a real change but one most likely due to chance.

Conclusions

The null hypothesis is rejected in the case of the experimentals and accepted in the case of the controls. The study found that there was a significant decrease in mean initial and final anxiety scores for the experimentals, but not for the controls. Further analysis of differences between the two groups, initially and finally, indicated that although the groups were unlike initially, they were similar at the end. Since the experimentals were beset with more anxiety at the outset than were the controls, the fact that finally they were both the same indicates a true decrease in anxiety for the experimentals. This finding is especially reinforced by the previous analysis of changes in mean scores.

Test Anxiety

Whereas the previous study reported findings concerning general anxiety among children as measured by Scale A, this substudy analyzes test anxiety among similar children. The study was conducted to provide further information concerning the role of anxiety among children experiencing bilingual education. Since Sarason (36) claims that the test situation "frequently evokes the anxious response at a strength...," thereby providing an overt measure of a less adulterated form of anxiety, it was decided to use his Test Anxiety Scale for Children. Only the last 12 items for the Test Anxiety Scale for children were used. Whereas the previous study reported results concerning the first 42 items of Scale A, this study reports the findings concerning the last 12 items of Scale A.

Analysis and Findings

Table 19 presents the results of the testings for both groups. It should be noted that initially the groups were alike in test anxiety. The mean difference of .54 was not significant. After two years, the final testing revealed that the groups were still not significantly different in terms of mean score. The analysis of final mean differences took into account the correlation between test scores on initial and final performances. When, however, the experimental group was examined for the extent of difference between initial test anxiety and final test anxiety scores, it was found that the experimental group had decreased significantly in test anxiety. A similar analysis for the control groups indicated that their decrease in anxiety was not significant. In both analyses the correlation factor was considered.

Table 19

Comparison of Initial and Final Anxiety Scores on the Last 12 Items of the Sarason Test Anxiety Scale for Children

		Initial Scores		Final Scores				
	No.	Mean	Sigma	Mean	Sigma	M-diff.	"t"	P
Experimental	162	7.66	2.91	6.60	3.55	1.06	2.36	Sig.
Control	97	7.12	3.33	6.40	3.52	.72	1.33	NS
Mean Difference		.54		.20				
"t" of the Difference		1.32		.61				
P of the Difference		NS		NS				

Conclusions

The null hypothesis is rejected in the case of the experimentals but accepted in the case of the controls. The study found there was a significant decrease between mean initial and final test anxiety scores for the experimentals, but not for the controls. Further analysis of differences between the two groups, initially and finally, indicated that there were no significant differences in mean score in either case. In terms of mean scores, the groups are basically similar initially and finally; the decreases, however, are real in the case of the experimentals, but only apparent in the case of the controls.

Summary

Whether anxiety is studied in terms of general anxiety or test anxiety, the findings indicate bilingual education has positive effects upon the reduction of anxiety among children.

Cultural Retention

A related sociological question arose concerning the effect of bilingual education upon the students' affinity for the culture of their parents. To examine the effect upon students participating in this study, a specially-devised Cultural Retention Form was administered to both control and experimental students.

Hypothesis

This aspect of the evaluation sought to determine if students of Hispanic-background who participate in bilingual Spanish-English classes develop a greater affinity for Spanish culture than comparable non-participating students. The hypothesis examined was:

> "There is no significant difference between mean scores achieved by experimental and control students on the Cultural Retention Form."

Assumptions

Since all students were selected upon the same basis initially and then assigned randomly to control and experimental classes, it is assumed that their initial affinity for, or rejection of, Spanish culture was similar.

Population

The Cultural Retention Form was administered in the control and experimental eighth grade classes of the nine junior high schools leaving the study as a result of city wide school-grade reorganization. These nine schools constituted the samples for our Two Year Study. From these nine schools returns for 214 experimental and 186 control students were analyzed. These 400 children had been in the bilingual experiment one or two years. Excluded from the analysis were any non-Hispanic background students who might have been placed in the control classes to bolster falling registers due to pupil turnover after the first year of the study. Also excluded were returns with illegible or ambiguous entries.

The Instrument

The instrument used to measure cultural retention or rejection by the students was the Cultural Retention Form which was referred to during the testing period "Scale B."

To secure items indicative of cultural retention or rejection, each N.E. Coordinator and science teacher participating in the study was asked to list on a special form five items indicative of student rejection of Spanish culture and five items indicative of student retention of Spanish culture. Returns received from the nine schools indicated 45 different items proposed by staff members as indicative of cultural retention. Items suggested covered a wide range of student activities, aspirations and habits. They included personal preference items relating to language usage, modes of entertainment and customs regarding food choice and appelation. Items regarding peer relations and group knowledgeability within the culture were reported.

The next step was to have these same schools locate five or more students who in staff opinion were definitely retaining Spanish culture and five or more who were definitely rejecting the culture. Students selected could not be in either the control or experimental classes. By this means 58 asserted cultural retainers and 49 asserted cultural rejectors were identified. These 107 students formed our pre-test population for determining which of the 45 items truly discriminated between cultural retainers and rejectors.

The next step in the instrument development was to conduct the pre-test. A 45 item version requiring a "Yes" or "No" response was composed and administered in the schools. Student anonymity was preserved and special instructions were devised to secure optimum student participation and reaction. Only code letters identifying students by type were used. Several promising items were excluded from the pre-test form because of their personal nature or potential of negative parent reaction.

Each item was analyzed in terms of the chi-square technique in which the "Yes" or "No" responses to the particular item of the cultural retainers and cultural rejectors were compared. The fifteen items appearing in the final form were those best discriminating between student types.

The final version was prepared and administered in June, 1966, in the nine schools of the Two Year Study. Answers were entered upon a special Digitek scoring sheet devised for the study; scoring was done under the supervision of the Coordinator of Optical Scanning of the Bureau of Educational Research. A high score indicated a cultural retainer and a low score indicated a cultural rejector.

Definitions

Hispanic or Spanish Culture - When the teachers were asked to provide items indicative of Spanish culture rejection or retention, they used the following guideline sent to them in the instructions. It is reproduced here to provide tbe flavor of what this term means in this study:

> "Bear in mind the age, socio-economic status and cultural background of the children. Children in early adolescence are more likely to have 'danced Latin' or read 'Novelas' than to have exhausted the significance of Don Quixote. However, do not underestimate the wide range of ability within any age group."

In essence, then, the term refers to those features of Hispanic-American life with which a child living in that social milieu would most likely be familiar, as characterizing the habits, preferences and lore of the Hispanic-American population.

Cultural Retainer - A child of Hispanic-American background who by overt actions indicates preferences, habits, and knowledges showing affinity for things of Hispanic-American culture.

Cultural Rejector - A child of similar background who shows the reverse tendency.

In giving instructions to the teachers asking them to identify such children the following terminology was used:

Cultural retainers - students "who evidence a greater interest in, participation in, knowledge of, appreciation for or pride in their Hispanic background than similar students."

Cultural rejectors - students "who give evidence of making a conscious or determined effort to 'break' from Hispanic culture or life in some definite way."

Procedures

During the last month of the Spring, 1966, term the control and experimental classes were given the Scale B test in the nine schools leaving the program. Scores were tabulated for both experimental and control groups; respective means and sigmas were computed and the "t" test for uncorrelated group mean differences was applied.

Analysis and Findings

Table 20 , below, summarizes the pertinent data and findings concerning the hypothesis examined in this study. Figure 1 presents a graphic picture of the frequency distributions of scores achieved by each group.

Table 20

"t" Test of Mean Differences in Scores Achieved by Experimental and Control Students on Scale B Test

	Number	Mean	Sigma	"t"	P
Experimental Students (Bilingual education)	214	8.61	2.94	8.53	.01 (Sig.)
Control Students (Conventional education)	186	6.22	2.72		

The table reveals that there is a pronounced difference in group mean scores that is statistically significant beyond the .01 level of confidence. The experimental and control group mean differences are not factors of chance. We must, therefore, reject our null hypothesis and conclude that the experimental groups are different from the controls in mean score; they tend to retain the culture more than the controls.

Conclusions

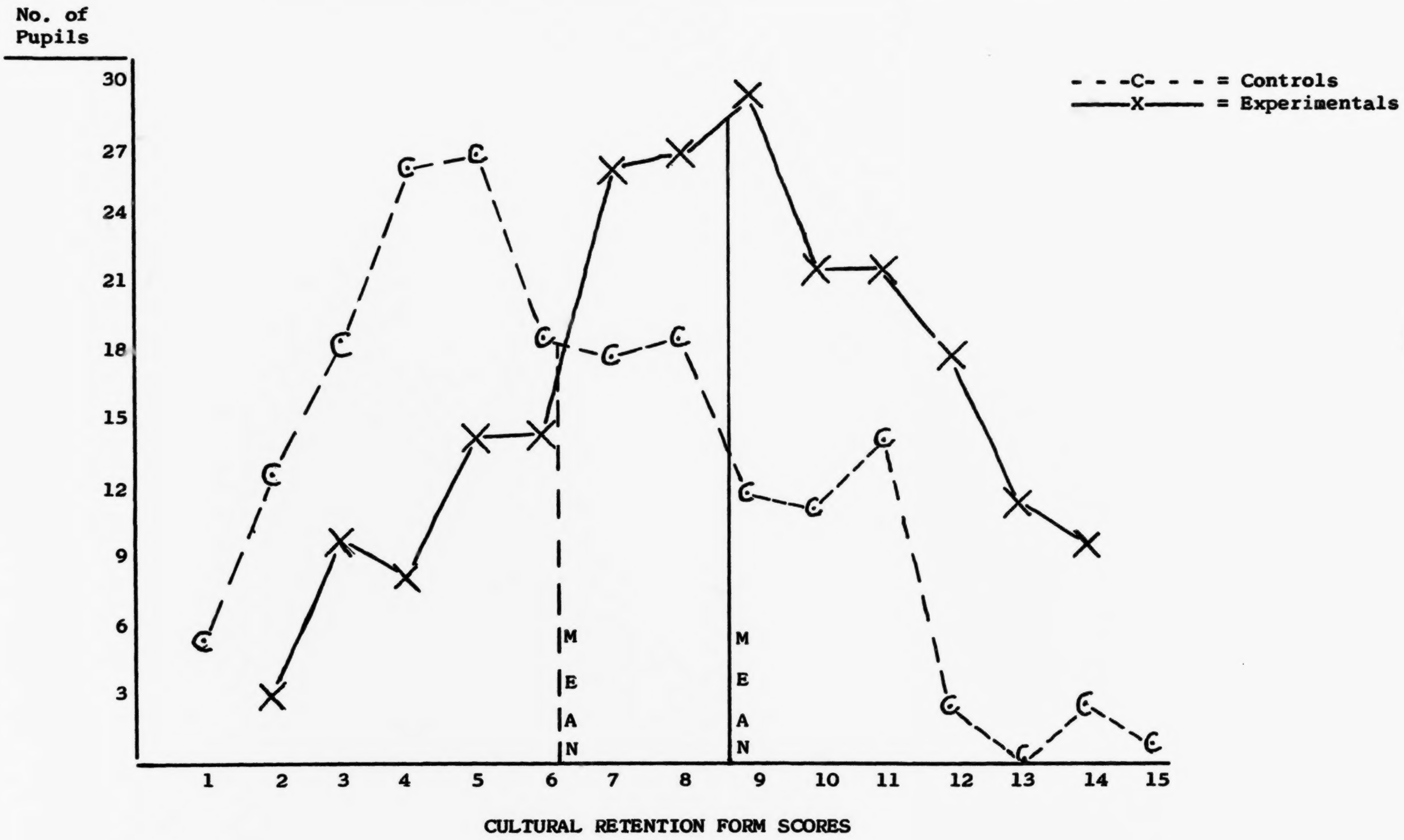
The data indicated in the table and figure lead to the following conclusions. Experimental students in a bilingual educational program do tend to retain or show a greater affinity for the culture of parents than comparable students in the conventional program. This finding is probably a factor of the program; the difference cannot be attributed to chance.

Although the experimentals exhibit a greater affinity for Hispanic-culture, both groups evidence some retention of Hispanic-culture. While the mean difference is large enough to indicate a high degree of statistical significance, it should be noted that it represents less than three points of difference on a sixteen point scoring scale. Not to be overlooked is the amount of overlap indicated in Figure 1 .

Bilingual education tends to make the student participants definitely more retentive of parental culture; it does not, however, make them so much unlike comparable students conventionally taught that large practical differences of social polarization occur.

Figure 1

COMPARATIVE FREQUENCY POLYGONS OF CONTROL AND EXPERIMENTAL SCALE B SCORES



Bilingual Dominance

Groups participating in the experiment consisted of experimental children exposed to bilingual instruction in (Spanish and English), and of control children exposed to conventional instruction in English. To determine to what degree, if any, bilingual instruction effected changes in the bilingual dominance of students in either group, a study was outlined comparing initial and final status. The measure of bilingual dominance was secured by means of The Personal Data Sheet described in detail in Chapter II under the heading "Special Instruments".

Hypothesis and Assumptions

The hypothesis examined in this study was:

> There is no significant difference between control and experimental bilingual dominance scores for students who have been in the program for two years.

It was assumed that random assignment of pupils to control and experimental groups at the program's inception equated groups on all variables. Furthermore, the drop-out of students during the ensuing two years is also assumed to be random, that is, drop-outs from either the control or experimental classes are of the same type.

Furthermore, although it is generally recognized that the re-administration of an instrument to a population after a two year period might lead to instability of response because of maturation and other factors, it is assumed that internal validity was preserved by providing a control group. This design assumes that any instability of response occurring due to history or maturation will be equivalent in both groups.

Terms

Bilingual dominance - as used in this study it refers to the extent to which students use both English and Spanish as reported on The Personal Data Sheet.

Procedures

The Personal Data Sheet which contained a measurement of student bilingual dominance was administered at the beginning of the program (October, 1964) to all control and experimental students, and, again at the end of the program (June, 1966). Initial and final scores for all children remaining in the control and experimental program were compared for mean differences. The conventional "t" test for uncorrelated groups was used to compare initial mean scores; the "t" test for correlated groups was used to compare final mean scores. A student using Spanish more than English was scored higher than a student using English more than Spanish. The scoring system is explained in Chapter II.

Population

Only students who had been in the program two years were included in this study. This eliminated those who had transferred from the schools during that time and those who had entered the schools after the initial testing date. Also excluded, of course, were those students who had neither an initial or final score because of absence during administration. Students participating in this analysis came from twelve participating schools. Thus, remaining for inclusion in this study were 301 students: 166 experimental students and 135 control students. Table 21 reports the descriptive and inferential statistics concerning the analyses.

Table 21

Comparative Mean Differences Between Control and Experimental Groups for Initial and Final Bilingual Dominance Scores

	EXPERIMENTAL			CONTROL				
	Mean	Sigma	No.	Mean	Sigma	No.	Mdiff.	"t"
Initial	18.58	3.02	166	16.99	3.38	135	1.59	4.29 Sig.
Final	18.18	2.87	166	17.11	3.18	135	1.07	4.11 Sig.
	r = .66							

Table 21 indicates that the experimental students and control students of the study population were not alike in the extent to which they used Spanish and English, either initially or finally. Initially, the experimental students were using more Spanish than were the control students as the comparative means of 18.58 and 16.99 indicate. This difference was not due to chance, as the "t" of initial mean difference indicates. For those students remaining in the program two years, the experimental groups were more prone to use Spanish than the controls at the beginning of the program in early seventh grade.

This difference favoring the experimentals was maintained throughout the two years. The final scores indicate that there is again a significant difference between control and experimental pupils: the mean score for the experimentals was 18.18, while that for the controls was 17.11. The "t" of 4.11 indicates a non-chance difference.

Since the groups remaining for analysis after two years could not be termed initially comparable in terms of mean score, thereby precluding any determination of what the final mean difference infers, it was decided to subject the data to an analysis of covariance. This technique adjusts the "t" for final mean difference for differences occurring in the initial variable. In essence the analysis of covariance seeks an answer to the question: Would the significant difference between final mean scores have occurred, had the groups been initially alike? Table 22 reports the results of the analysis.

Table 22

Analysis of the Covariance Regarding Control and Experimental Initial and Final Bilingual Dominance Scores

Source of Variation	dg	SSx	SSy	Sxy	SSy.x	Msy.x(Vy.x)	
Between Means	2	189	123	127	38	19	Fy.x = 3.59 (significant)
Within Groups	298	3019	2719	1860	1573	5.29	
	300	3208	2842	1987	1611		

The table indicates that the variances were computed by dividing each SS of the adjusted sums of squares by its appropriate dg. Owing to the restriction imposed by reduction of the variability in X, the table shows only 300 df. Application of the F-test to the adjusted between and within variances indicates a significant difference between final scores. Since the significance levels indicated for the degrees of freedom in question are 3.03 for the .05 level and 4.68 for the .01 level, the reported Fy.x of 3.59 is significant between these levels. It is clear from this Fy.x that the final means differ significantly after they have been adjusted for initial differences in scores.

Conclusions

The null hypothesis is rejected. The experimentals have a significantly different, final mean bilingual dominance score from the controls. Even when initially equated through analysis of covariance, the final scores indicate that the experimental children tended to use more Spanish than the control students after two years of program experience.

Report Card Ratings

Bilingual education was viewed as a possible calalyst for effecting changes in the cognitive and affective areas of student development. To examine the validity of the latter aspect a study was made concerning the non-cognitive areas of personal and social development as recorded on student report cards at the end of seventh grade.

Hypothesis

The four aspects of personal and social development listed on the report card were; conduct, effort, reliability and self-control. Each aspect was separately tested in terms of the following hypothesis:

> "There is no significant difference between report card ratings received by control and experimental students at the end of eighth grade."

Assumptions and Limitations

The theoretical assumption is that positive growth in an achievement area such as science will, for bilingual students, have a related positive effect in non-cognitive areas. It is recognized that teacher ratings on report cards in the four areas examined are only a segment of the totality of student personal and social development. It should also be noted that the findings relating to "conduct" and "effort" are on the basis of a student population of 491, whereas the findings for the studies of differences in "reliability" and "self-control" are on the basis of a student population of 426. The difference in numbers is due to the necessity of dropping the control and experimental classes from the latter studies because marks were not entered on The Pupil Profile Sheet in one school. It is assumed the loss of this one school does not dramatically alter the results.

Population

The study of "conduct" and "effort" involved 491 students: 246 were control students, while the remaining 245 were experimental students. These students were from nine of the fourteen schools. However, they represented a 100% sample of all schools leaving the study at the end of second year.

The study of "reliability" and "self-control" consisted of 426 students: 214 were control students, while the remaining 212 were experimental students. They came from eight of the nine schools terminating the study at the end of the second year.

Instruments

The student report card ratings were entered by the teachers in each school upon The Pupil Profile Sheet. These sheets were mailed to the office where the data was transcribed for analysis.

Definitions

Personal and Social Development --- as used in this study the term refers to conduct, effort, reliability and self-control within the context of meaning each has when teachers make student evaluations for report card purposes.

Procedures

To secure the subjects for the study all eight grade classes in schools leaving the study at the end of eighth grade were included. It was decided to use the total class population which would include some students who were in the experimental program one year and some who had been in it for two years. Since the numbers of each category are similar for control and experimental classes the populations are comparable.

Students were rated by teachers for each trait on the basis of a four letter scale: "O" meant outstanding; "S" meant satisfactory; "N" meant needs improvement; "U" meant unsatisfactory. For analytical purposes the following grouping system was used: students with an "O" or "S" rating were considered acceptable in the trait rated: students with a "U" or "N" rating were considered unacceptable in the trait rated. Analysis was made on the basis of this dichotomy as well as that of experimental and control. A standard chi-square technique was used.

Analysis and Findings

The table on the next page reports the chi-square figures for each trait in terms of the groupings compared.

Table 23

Comparative Analysis of Control and Experimental Students Ratings on Four Traits Appearing on Report Cards

Trait	Rating	Control	Experimental	Chi-square
CONDUCT	Acceptable	203	212	1.51 N.S.
	Unacceptable	43	33	
EFFORT	Acceptable	151	186	12.05*
	Unacceptable	95	59	
RELIABILITY	Acceptable	156	180	9.22*
	Unacceptable	58	32	
SELF-CONTROL	Acceptable	165	176	2.33 N.S.
	Unacceptable	49	36	

* = significant

The table indicates that in two of the four traits examined there is a significant relationship between being classified as an experimental or control student and the type rating one receives on the report card. Those traits in which this was found were "effort" and "reliability." In the other categories of "conduct" and "self-control," although the experimentals are more frequently acceptable than the controls, we cannot say this is not a chance factor. Differences between groups in ratings received on these two aspects were not statistically significant.

Conclusions

The null hypothesis is rejected in the cases of "effort" and "reliability" but accepted in the cases of "conduct" and "self-control." Experimental students are better than control students in the former traits, but they are not different in the latter.

Summary

In examining the effect a bilingual educational experience had upon experimental students' personal and social behavior, it was found that for those eighth grade students experiencing the program their behavior in terms of conduct and self-control was not substantially different from that of the controls. Nevertheless, teachers indicate by ratings that the experimental students are definitely trying harder in the areas of personal and social development; teachers also found the experimental groups definitely more reliable.

Classes of Hispanic-background students who receive science education in Spanish rather than in the conventional English show definite signs of trying harder and being more reliable. However, no dramatic differences in overall conduct and self-control should be expected. The atypical child in these categories does not exhibit overt behavior meriting significant changes in teacher ratings on report cards. But, something is happening which teachers noticed so much that they did rate these same children definitely better in the extent to which they try and can be relied upon.

Attendance

An inspection of attendance records was planned to determine whether any differences in attendance patterns were discernible. Possible positive or negative effects were to be reported by comparing control and experimental attendance patterns.

Hypothesis

The hypothesis under study is:

> "There is no significant difference between control and experimental student attendance patterns."

Assumptions and Limitations

The basic assumption underlying this study is that an improvement in school achievement is concomitant with an improvement in attendance. The findings should be interpreted in terms of the following limitations. Students not on register a full term were excluded; also excluded were those attending school for less than 87 days, though on the register all term. Results are further limited to schools in the Two Year Study and pupils on the eighth grade level. Furthermore, it should be remembered that all students were approximately two years retarded in English reading ability upon entering junior high school. All results are limited to schools and populations of this type.

Population

The study consists of 522 students: 264 control students and 258 experimental students. The students were from the eighth grades of ten schools participating in the experiment. Excluded from the study population were two student types: first, those who had not been in the school 186 days (the school year for 1965-1966); second, those students who were severe truants or ill for long periods of time. To determine criteria for student exclusions the following systems were employed. Students who were on register for 186 days but in attendance less than 87 days were considered either seriously ill or chronic truants. Also, those on register less than 186 days were excluded regardless of days in attendance. In scanning the attendance data for the last group it was found that although there is high pupil turnover in most of these schools from year to year, most of the pupil turnover does not occur until the school year has ended. Apparently, most of the relocating for children occurs in the summer, since over ninety percent of those on register in June were in the school since September. However, nearly one-third of these were new entrants as of September.

The population included students in control and experimental classes who had been in the school either one or two years.

Instrument

The instrument used to secure the data concerning attendance was The Pupil Profile Sheet completed by the teachers in the respective schools from local school records. They entered the number of days a student was present; the number absent; and the number half-days of attendance.

Procedures

In computing the number of days a student was present, half-days were counted as days present. If a student was present 160 full days, absent 16 full days and present 10 half days, his total attendance was considered 170 days present and 16 days absent. This was done for both control and experimental groups. Lateness was not taken into consideration in this study. The attendance data for controls and experimentals were grouped into separate frequency distributions which were then treated to determine the cumulative frequency distributions. As expected, the data was not normally distributed and therefore non-parametric statistics were used. The Kolmogorov-Smirnov "D" test for two-group, large samples was employed. Basically, this non-parametric technique compares the maximum difference between ogives with a critical value. If the difference equals or exceeds that value the null hypothesis is rejected; if not, the null hypothesis is accepted.

Analysis and Findings

An inspection of the data in the following table indicates that the distributions of experimental and control students regarding number of days attending school are basically similar. Both distributions are non-normal thereby eliminating parametric analysis. The maximum difference between the cumulative frequencies in percentages was .04, that is, four percent. For a difference to have been considered powerful enough to reject the null hypothesis the critical value would have to be .38 or 38 percent. Since the difference did not even approach this critical value we may assume there is no true difference between groups regarding attendance patterns.

Table 24

Cumulative Frequency Distributions of Control and Experimental Students

	CONTROL		EXPERIMENTAL		
No. Days Attending	No. of Students	Cum. "f" %	No. of Students	Cum. "f" %	
182-186	70	1.00	61	1.00	
177-181	40	.73	52	.76	
172-176	38	.58	43	.56	
167-171	35	.44	30	.40	= Maximum Difference (.04)
162-166	25	.31	24	.28	
157-161	15	.21	11	.19	
152-156	8	.16	11	.14	Critical Difference (.38)
147-151	10	.13	5	.10	
142-146	7	.09	5	.08	
137-141	3	.06	6	.06	
132-141	3	.05	2	.04	
127-131	2	.04	1	.02	
122-126	1	.03	0		
117-121	0		0		
112-116	1	.03	0		
107-111	0		2	.02	
102-106	1	.02	0		
97-101	0				
92- 96	1	.02	1	.02	
87- 91	4	.02	4	.02	
	264		258		

Conclusions

The null hypothesis is accepted: there is no significant difference between control and experimental students when ogives of student attendance patterns are compared.

Summary

An analysis of comparative attendance patterns of experimental and control students in Two Year Study schools revealed, when ogives of attendance patterns were compared by non-parametric techniques, that no true difference was found. The expressed belief that improvement in achievement would result in improvement in attendance did not seem warranted in this case. When it is recalled that most of the experimental factor was limited to one area, science, it is perhaps too much to expect decisive changes in other areas. Perhaps a more broadcast experimental factor, such as, bilingualism in instruction, if successfully applied to more achievement areas, the halo effect of improving non-cognitive areas might result. However, the decided improvement exhibited by the experimental classes in science achievement apparently does not result in a behavioral change in attendance patterns. The magnitude of the achievement improvement does not seem strong enough to affect less positively related areas; perhaps the assumption that attendance is a positive factor of good achievement is, in itself, questionable with these students.

Principals' Questionnaire

A four page questionnaire was mailed to the principals of participating schools at the end of the two-year program. Returns from ten principals were analyzed in order to ascertain their opinions of the program. The questionnaire asked seven open-ended type questions concerning specific aspects of the program, and one closed-response question concerning overall opinion of the program. A fourth sheet was provided the principals upon which they were to enter "other remarks" they felt pertinent but otherwise not included. The aims of the questionnaire were twofold: first, to provide guidelines concerning implementation (future bilingual programs); second, to provide a summary of present program experiences.

The Findings

Item 1 - directed: "Please indicate your own personal opinion of the possible advantages or disadvantages of the Science-Spanish Experiment in your school."

Responses indicated such positive aspects as: The improvement of the self-image of the Hispanic-background child; the improvement of class morale; the improvement of achievement in science; the value of providing these children an opportunity to learn Spanish as a foreign language; the decrease in the number and severity of discipline problems and the provision of useful specialized curriculum material.

Responses indicated such negative features as: The necessity for grouping along ethnic lines; the programming problems involved in maintaining homogeneity and in maintaining an experimental and control situation (the controls were ethnically grouped but, of necessity, received no advantage from it); the difficulty of maintaining a longitudinal program with a high turnover rate of pupils; the incursions of testing into the school time; teaching technical terms in science in two languages; and the problem of selecting a defined population for program needs.

Item 2 - asked the principals to provide information relevant to the decision-making process. They were instructed: "This information should be of the type you feel should be considered by a policy maker faced with the necessity to decide whether or not bilingual instruction should be implemented in the schools."

Responses indicated that certain conditioning factors, would, in the opinions of the principals, determine the success or failure of the program. Among these factors were the following:

1) The necessity of having a teacher fluent in both languages. This was the most frequently reported factor.
2) The need for considering high pupil turnover in project areas.
3) Student ability in Spanish must be considered carefully in initial class organization.
4) The need to provide suitable curriculum material should be considered.
5) The need for a bilingual supervisor of special lessons, since most supervisors are monolingual.
6) A community public relations program should precede institution of a bilingual program.
7) It must not be assumed that all Puerto Ricans favor the instruction of students in Spanish.
8) Close rapport should be maintained between the coordinator and the schools.
9) Initial orientation of pupils is necessary.
10) The director should understand the programming difficulties involved and be prepared to handle them.

Item 3 - directed the principals to comment upon the project's aims or implementation in their particular schools. Responses indicated a variety of contentions and experiences. In some cases parents voluntarily came to the school to praise the project, in other cases class morale seemed low because students could not handle the Spanish language as well as anticipated. Some principals felt the program success was a factor of teacher ability; others felt it was a factor of proper student selection. Some principals endorsed wholeheartedly the aims of the program; others disagreed with the idea of bilingual instruction. Some lauded the advantage the program gave Hispanic-background students by allowing them to study Spanish in junior high school; others insisted that science should never be taught in anything but English.

Item 4 - read as follows: "Please indicate in the space provided any noticeable effect the program had in your school concerning: pupil reaction, parent reaction, guidance department reaction, staff reaction, and supervisor reaction. We do not expect you to poll each of these various groups, but, instead we seek salient items which were brought to your attention by any of these groups. The following responses were made:

1) "Pupil reaction was good when we had a good teacher; poor when she went on maternity leave and we had a poor teacher; good, again, when we found a good teacher. Staff reaction was 'let's wait and see the results!"

2) "Pupil and parent reaction in the beginning had to be directed by group conferences and individual conferences in order to compensate for the feeling that these Puerto Rican youngsters were being segregated. The general staff and supervisory reaction was that bilingual instruction is an excellent goal but using science as a subject vehicle was a very difficult way of achieving it."

3) "The attitude of the children towards learning to speak and to read their native tongue improved. They are no longer embarrassed by references to anything that concerned Puerto Rico or Puerto Rican culture... There has been very little response from parents."

4) "Since the pupils found the vocabulary in the Spanish texts too difficult they became confused in understanding some of the scientific concepts...Many of the parents resented the use of Spanish in the classroom since they were more interested in their children's progress in the mastery of English...The teacher of Spanish felt that she could not spend time training the pupils in esoteric science vocabulary that was not required in the actual course of study. She felt that their ultimate success in the City-Wide Test would be affected adversely.

5) "All reactions were positive. Teachers participating reported especially positive reactions in the area of pupil discipline. Parents with whom the project was discussed all indicated their satisfaction."

6) "The most noticeable effect, unfortunately, was that the class receiving the instruction became an outstanding disciplinary problem, whereas the control class showed no such tendency."

7)* "Pupils liked it. Staff liked it. The teacher said the pupils enjoyed the course. Parents expressed satisfaction when they came in during parents visiting days."

* Seven excerpts from the ten principal returns are reported. Three are omitted because principals made no response to this particular item, or indicated "no significant reactions."

Item 5 - sought information concerning the suitability of the curriculum material provided the school for the implementation of the experiment. Again, responses varied; they seemed, however, to be a factor of class ability in Spanish. Responses indicated that some found the material suitable and most helpful; others thought the mimeographed material was excellent, but the texts of little value. Still others found the material generally useful, but some felt that too much individual attention had to be given students who were deficient in Spanish. Some simply commented that the material was too difficult.

Item 6 - requested the principals to make any suggestions they felt pertinent to the organizational aspects of bilingual education. Responses indicated that some felt the program might be tried in another curriculum area, others felt keeping the class homogeneously grouped in Spanish-speaking ability was essential to program success, others indicated the extra time needed to implement such a program, others suggested there be annual student and teacher reaction reports, others insisted upon the necessity of a fluent, Spanish-speaking teacher.

Item 7 - "Please indicate your opinion concerning the principle of bilingual instruction in our schools. Your responses should not be restricted to your particular school situation or to this particular project, but should consider the principle in general."

Principal responses indicated:

1) "Bilingual instruction in all subject areas...may result in a lack of the desire to learn English...pupils may not learn any more than marginal English...hampering their progress in later life in this country. I believe that the second language, outside of foreign language classes, may be used, but should not be used as extensively as English."

2) "We've tried bilingually to help Non-English pupils orient to our schools. It might be good where we need it."

3) "In principle, I do not accept this. I believe that in practice it stigmatizes Puerto Ricans, although it seems to be very tolerant but the question always comes up---why bilingual programs in Spanish only?"

4) "Little value in content area for children who know English - could, of course, be most valuable in that aspect for new arrivals. Valuable for purposes of ethnic pride and self-identity."

5) "I approve the principle of bilingual instruction in our schools, especially insofar as Spanish is presented in a very functional setting. I also feel that the effect of bilingual teaching on the self image of pupils and parents will eventually succeed in positively affecting this self image."

6) "We feel that English should be the only language used in the instruction of our pupils so that they may better prepare themselves as productive citizens of the community and the nation. The teaching of technical subject matter should be deferred until such time as they are able to function effectively in English."

7) "With qualified teachers, this is a valuable additional aid in teaching foreign language."

8) "I am only in accord with bilingual instruction in the schools. In fact, I would recommend that it be started and increased on the elementary school level."

9)*It deserves more experimentation and evaluation."

* One principal did not respond to this item; this explains why only nine responses are reported.

Item 8 - Asked the principals to make an overall evaluation by checking one of six statements concerning the experience. Several principals checked more than one statement, explaining why there are more than ten responses. The options offered and the total number of checks made for each option are presented below:

OPTIONS

A. I would like to see it continued if funds and facilities permitted.

B. I would like to see it tried with a different type pupil.

C. I would like to see it tried in a different subject area.

D. The pros and cons seem about equal.

E. I have many reservations about the project.

F. I would like to see it discontinued.

Response Pattern	No. of Responses
A	1
B	0
C	1
D	1
E	2
F	1
A and B	1
C and E	1
B and E	1
No Response	1

"Other Remarks" - As explained earlier, a fourth page was appended to the questionnaire allowing principals to incorporate any other remarks they felt pertinent but not covered by previous items. Two principals availed themselves of this opportunity. The substance of their remarks are recorded below:

Case A. This report came from a principal who indicated previously that he would like to see the project continued with a different pupil type, but that he had reservations about the project at this time. In short, he checked options B and E in response to Item 8. His feeling was that the teachers should have undergone training a term before the program began. He also felt that although the project material developed by the project team was most valuable, the textbooks from Spain were inappropriate.

Case B. This came from a principal who checked option F. His experience was such that he felt the program in his school was a "flat failure;" he felt, though, that this was not

> necessarily a condemnation of the program itself, considered in general terms, but a factor of individual characteristics peculiar to his school. He offered these as possible explanations and guidelines for those implementing future programs. His first statement was "Our Puerto Rican students have been in New York City for all their school period or often all their lives. Therefore, the basic assumption behind the program operates not at all or feebly. They want to be American not Puerto Rican...the theory that they would shine when they realized that the community appreciated their special culture did not apply. The negative factors were stronger. However, if a group of Puerto Rican students can be found...who have just arrived from Puerto Rico or who actually have a better mastery of Spanish than English, the results might be very different."

Conclusions

The interest of objectivity would not be served were it to be stated that principals unanimously approved the project. Nor would such objectivity be served were the principals' responses interpreted without an understanding of the psychological framework within which this project was conducted.

The project repeatedly emphasized to participants that the project was instituted more to find out what would happen than to prove something did happen. Experimental in nature, the candid opinions of all participating were encouraged and sought. Participants generally realized that the results would be used to determine what type, if any, bilingual program should be instituted on a school-wide basis. Interviews with the principals affirmed the professional interest with which judgments were made. The Principals Questionnaire was not so much an evaluation of the present project as an instrument to provide guidelines for future decisions.

Valuable advice based upon a variety of experiences in differing locales of the city, serving Hispanic-background pupils of different sociological characteristics, has been forthcoming. Among the major guidelines emanating from these returns are:

1) The inadvisability of a "buckshot" approach to bilingual education. Returns indicate that in some schools it was a marvelous success; in most schools it demonstrated some positive value but also revealed problem areas; in one school the principal termed the experience a "flat failure."

2) Guidelines for insuring a successful program seem to be the following:

    a- secure a student population capable in Spanish
    b- use only a science teacher fluent in Spanish
    c- pre-train teachers before program inception
    d- keep the suitable curriculum material but discard that which is found to be too difficult
    e- orient the community and parents, as well as staff members, to the aims of the experience
    f- secure parental consent and student consent before placing students in class
    g- assist the school with proper equipment, staff, and materials in order to overcome the imposition of time and effort such a program involves
    h- provide staff orientation and secure staff cooperation

Professional Staff Opinion

While a statistical analysis of comparative mean score differences will provide an overall comparison of student performance for any given variable, it only provides an overall result concerning all the schools. Little is known of the particular benefits or deficiencies experienced in any one school. Furthermore, in matters of school program implementation an observer, such as a teacher, living with the program an entire school year can frequently observe positive and negative values not measured by tests. To offset these "loopholes" in evaluation, a survey of professional staff opinion was made. The survey consisted of a Teacher Questionnaire and of a Principal Questionnaire.

The Teacher Questionnaire

A two-page questionnaire consisting of 13 items was sent to 60% of the schools in the study at the end of two years. Returns from the schools consisted of 16 questionnaires because in some cases the NE coordinator and the assistant principal used the extra copies to record their opinions; the other questionnaires were received from either science or Spanish teachers who had taught the experimental class.

The Findings

Findings are reported in two ways: first, tabular; second in paragraph form. This dual means of presentation is necessitated by the nature of the items. In some cases the items permitted statistical summary in the form of descriptive statistics; in other cases the items require selecting representative samples of responses and interpretation. Items 1 through 8 inclusive, and item 12 lend themselves to statistical tabulation; items 9, 10 and 11 require a non-statistical presentation.

Item 1 - received the most number of positive responses. Ten of the twelve teachers felt the program had definite positive effects upon changing student attitudes toward learning the subject. This was reported among science and Spanish teachers. There is only one case in which it recorded a negative attitude.

Item 2 - indicated that in at least half the cases students changed attitudes toward the teachers. In only one case, again, was their a negative response. Other responses indicated no discernible change.

Table 25

Frequency and Type Response Made to the First Eight Items of The Teacher Questionnaire

	Positive Response		Neutral Response		Negative Response		No Response*	
	No.	%	No.	%	No.	%	No.	%
1- Student attitude toward learning the subject	10	71%	1	7%	1	7%	2	14%
2- Student attitude toward the teacher	7	50	3	21	1	7	2	14
3- Student attitude toward use of Spanish	7	50	0	0	5	36	2	14
4- Student attitude toward educational plans	6	43	7	50	1	7	0	0
5- Student attitude toward children using Spanish	8	57	4	29	1	7	1	7
6- Student behavior in class	8	57	3	21	1	7	2	14
7- Improving classroom participation	6	43	7	50	0	0	1	7
8- Student attendance	7	50	6	43	0	0	1	7

* In most cases the No Responses represent returns from the two non-teachers

Item 3 - is paradoxical in response pattern. Where seven teachers, half the sample, indicate positive changes regarding student attitude toward use of Spanish as a language, five teachers, over one-third, indicate the program had negative effects. An investigation of the negative responses indicated that some teachers found the class reacting to learning formal grammar; in another case the class reacted to the difficulties of learning technical scientific terms in Spanish; in another case the class did not appear to be oriented in that they "questionned" the use of Spanish. The analysis of negative responses indicates local rather than program problems. Analysis of the positive responses indicated all of the difficulties listed as negative reactions by the five teachers reporting unfavorably had been encountered and successfully hurdled by the teachers reporting positively.

Item 4 - less than a majority reported clearly positive changes; half reported no changes in educational planning while one reported negative results. Apparently the program effects some positively, but most do not change their goals.

Item 5 - in all but one case the parent reaction was reported as favorable or neutral; in only one case did a teacher report unfavorable reaction from the parents.

Item 6 - while a majority felt that the program had positive benefits upon student behavior, twenty-one per cent indicated no change. One case reported negative reactions.

Item 7 - half the teachers found no change in classroom participation, but over forty per cent reported positive changes. No negative changes were reported.

Item 8 - while half reported positive changes, nearly as many teachers reported no changes in attendance. All agreed the program did not effect negative changes.

Items 9, 10 and 11 requested information from teachers which did not lend itself to tabular presentation because of the open-ended nature of the item. In the following section salient responses to each of these items are presented.

Item 9 - Teachers were asked: "What are the positive features you feel this project has from a teacher's viewpoint?"

The following are synopsis of the replies teachers made.

a. It gave students who would not normally have been permitted to take a foreign language a chance to become proficient in Spanish.
b. Close knit competitive spirit. Conduct and work habits improved.
c. Aware of the scientific terms in Spanish, they may profit later on.
d. It is easier to teach a homogeneous group.
e. It has helped these children find themselves, see new horizons, and improve in English, Science and Spanish.
f. The project is a very good one; however, it should have been done with a class of higher reading grade.

g. The pupil-teacher relationship was closer and more effective
h. Given the good material to work with, the program is a challenge to the teacher's ability to develop in the students an interest and fluency in Spanish that is seldom possible with a mixed group.
i. Individualized attention.
j. Good atmosphere in the classroom due to the use of Spanish.
k. The selection of the class lends itself to good teaching.
l. It gives or inculcates pride in the students. It gives them a sense of belonging.
m. Undecided.
n. None, since children prefer to use English.

Item 10 - Teachers were asked: "What special preparation and planning has been necessary on your part (other than what you would do with a regular non-project class) to conduct the project class.

a. Extra oral - preparation to overcome shortcomings of some students' background.
b. Special consultations with Spanish teacher.
c. I had to review my Spanish carefully.
d. No response.
e. None.
f. Extra work regarding mimeographing material.
g. Necessity of planning more exciting lessons.
h. No response.
i. The planning of specific motivations and displays in bilingual form.
j. No response.
k. Discussion of certain lessons with Spanish teacher.
l. Working closely with science teacher.
m. Simplification of material in Spanish.
n. No response.

Item 11 - Teachers were asked: "What are the negative features you feel this project has from a teacher's viewpoint?"

a. Material too difficult.
b. Some students were retained in the class for experimental reasons who should have been transferred to other classes in which they would have benefited more.
c. Although students were Spanish-speaking, learing scientific terms was for them like learning another language.
d. Only a science teacher with a fluency in Spanish should handle this type course.
e. No response.
f. Requires an excellent knowledge of Spanish and science on part of the teacher.

g. More coordination among the science, English and Spanish lessons.
h. Class is better suited for average or brighter Spanish-speaking students.
i. Pupils began to feel themselves exclusive because of unique program.
j. Isolates class, because of block-programming, from other students.
k. Nothing negative.
l. Teacher must be fluent in Spanish.
m. No response.
n. No response.

Item 12 - Consisted of two questions seeking teachers' overall reactions to the program. These questions served as criteria items of professional staff reaction.

In 12-a teachers were asked to check one of three responses concerning opinions of the program. The item read: I think the project as conducted in my school is:

( ) beneficial
( ) inconsequential
( ) handicapping as far as students are concerned

Responses indicated 9 teachers rated the program beneficial
4 teachers felt it was inconsequential
1 teacher felt it was handicapping

In 12-b teachers were asked to check one of three responses concerning their overall reactions to the program. The Item read: My overall reaction to the Science-Spanish Project in my school is

( ) favorable
( ) undecided
( ) unfavorable

Responses indicated 8 teachers indicated a favorable reaction
3 teachers indicated an undecided reaction
1 teacher indicated an unfavorable reaction
1 teacher did not respond

Conclusions

Professional staff responses indicated a generally favorable reaction to the program. It should be noted that teachers felt students improved in many areas. The program, however, does not meet with unanimous endorsement; it can be expected, however, that if a similar program is instituted in the schools most teachers will favor the program, but a slight minority will experience negative reactions.

The Effect of Teacher Language Ability

In organizing the program previous to the inception of the actual study it became obvious that enough science teachers who were fluent in Spanish could not be secured. Rather than reduce the number of schools participating an alternate staffing arrangement was proposed. In this arrangement teachers who were not fluent in Spanish but who had some familiarity with the language were selected for participation in some schools. These teachers worked with the school's teacher of Spanish to ready materials and lessons. This alternate staffing approach was studied intensively by Bolger (4). If the alternate staffing system was successful, policy makers planning large scale implementation of the program would have little difficulty in securing staff; if, however, the results showed that only fluent, Spanish-speaking teachers could staff this type program, the teacher recruitment task would be more difficult.

Hypothesis and Assumptions

To examine this aspect of the program students in experimental classes taught by fluent, Spanish-speaking science teachers were compared for science achievement with students in experimental classes taught by teachers of the alternate type. The hypothesis examined in this case was:

> "There is no significant difference in student science achievement at the .05 level of confidence between experimental students taught by fluent, Spanish-speaking teachers and experimental students taught by teachers of the alternate type."

The basic assumption is that the alternate staffing approach will be as effective as the original staffing system which employed only fluent teachers.

Definitions

Fluent Spanish-speaking science teacher - a science teacher fluent in both English and Spanish. This teacher spoke Spanish without hesitancy

Alternate type teacher - a science teacher not fluent in oral Spanish but familiar with it from having studied it in school. His oral Spanish had an English accent and was hesitant, or he spoke in stereotypes requiring frequent mental translation

Population

The study consisted of 204 experimental students taught by nine fluent teachers in nine study schools, and of 140 experimental students taught by seven alternate type teachers in seven study schools. The study examines the differences in science achievement among these groups of students at the end of seventh grade, after completion of one year in the program.

Procedure

The 204 experimental students taught by fluent teachers were compared for initial and final science score differences with the 140 experimental students taught by the alternate type teacher. Groups were matched for initial mean comparability on The Basic Test of Science Knowledge and compared for mean differences on the science achievement test, Bilingual Science Test I, administered at the end of seventh grade.

The Findings

The table indicates there were 344 students available for comparison at the end of seventh grade. All students were in experimental classes. The table presents the results of an examination of experimental students for initial and final mean science differences.

Table 26

Comparative Performances on Initial and Final Tests of Experimental Students in Classes Taught by Fluent Type Teachers and by Alternate Type Teachers

	INITIAL			FINAL		
	Mean	Sigma	N	Mean	Sigma	
Experimentals Taught by Fluent Type	35.17	6.94	204	21.47	7.93	
						r. = .34
Experimentals Taught by Alternate Type	35.77	7.18	140	19.86	5.01	
	Initial Mdiff.		.60	Final Mean Diff.		1.61
	"t"		.77	"t"		2.44
	P		NS	P		significant

The table indicates that although the experimental students taught by the 9 fluent teachers and those taught by the 7 alternate type teachers were initially comparable in terms of mean scores on The Basic Test of Science Knowledge, the final mean differences in science achievement on The Bilingual Science Test were significantly different. Those experimental students taught by the fluent teachers were higher on the average than those taught by alternate type teachers.

Conclusions

The null hypothesis is rejected. The experimental students taught by fluent teachers are higher in average science score at the end of seventh grade than those experimentals taught by alternate type teachers. The assumption that either staffing system was equally efficacious must be rejected.

CHAPTER V

SUMMARY OF FINDINGS

The evaluation of the Science-Spanish Experiment focused upon three areas: achievement, personal and social development and the reactions of the professional staff. In the area of achievement, studies were undertaken concerning English, mathematics, science, Spanish and social studies, major emphasis was upon science and Spanish. In the area of personal and social development studies were undertaken concerning anxiety, attendance, bilingual dominance, conduct, cultural retention, effort, reliability and self-control. In the area of professional staff evaluation, survey studies were made of principals' and staff members' reactions to the idea of bilingual education and to the program experience itself.

The findings concerning any of the particular areas evaluated are presented in cryptic form in the section, "Statement of the Results." Rather than present a repetition of the conclusions to each study, salient items of note concerning an area, or several areas combined, will be discussed in this summary. The format followed is that of presenting a leading question and answering it in terms of information received from several aspects of the evaluation.

1. How did bilingual education affect student achievement?

Student achievement is positively affected in science and in Spanish, but was not affected in social studies or mathematics. The apparent rationale for this is that the latter two subject areas were taught in English whereas the science and Spanish classes were taught bilingually. To expect a positive performance in bilingually taught classes is warranted, but to expect this achievement improvement to carry over into subject areas not bilingually taught is not warranted.

Student achievement in the experimental classes was superior in science and in Spanish but unaffected in mathematics and social studies. In the seventh grade the average score on the bilingual science test was 1.1 score points higher for the experimentals; in the eighth grade, 3.2 score points higher for the experimentals. Comparative analysis of eighth grade report card ratings revealed an average three point superiority favoring the experimentals. All differences were statistically significant. Superior classroom performance of experimental classes, however, was found primarily in schools having fluent, Spanish-speaking teachers.

2. What effects did the program have upon student language?

Program effects upon student language were examined from the aspect of achievement in learning Spanish, achievement in learning English, English reading ability, and bilingual dominance.

It was found that bilingually taught students excelled in learning Spanish. It must be remembered that most of these students were approximately two years below grade level, initially, in English reading ability. They, therefore, under ordinary circumstances, would not have been permitted to study a foreign language in junior high school, since this is reserved for those students who function on grade level in English. The experiment demonstrated that students with an audio-lingual ability in a foreign language spoken at home, but functioning with a disability in English can progress much more rapidly than their native continental-born counterparts who are on grade in English.

The evidence seems to indicate that in the case of bilingual children, English reading ability should not be the only criterion for permission to study a foreign language in the junior high school. An audio-lingual ability, among other factors, should be considered a suitable substitute. Furthermore, it must be mentioned that the experimental students, already possessing an audio-lingual familiarity with the foreign language, were not subjected to the usual audio-lingual dominated methods used for native monolinguals studying Spanish as a foreign language. They, instead, concentrated more upon formal grammar, in which they were weak.

In the area of English, it was noted that the common fear that bilingual education would result in a diminution in English language ability was not substantiated. In the area of classroom English achievement, the experimentals did as well as the controls, and in the area of English reading ability, they did much better than the controls. There seems to be some justification for the contention that mastery of one language has a transfer effect upon another language.

In the area of bilingual dominance, it was found, as expected, that the bilingually taught students tended to use Spanish more frequently than the controls. This however, was accompanied by the general improvement in English mentioned previously. The experiment, then, had the effect of improving the students in both languages, while at the same time, causing the experimental students to use Spanish more than their control counterparts.

3. What effects did the program have upon student personal and social development in school?

Teacher ratings on report cards at the end of eighth year were examined concerning student effort, reliability, conduct and self control. Evaluation revealed that the experimental students were superior to the control students in effort and reliability, but no better or worse in conduct and self control. Relating this finding to other information obtained by means of interviews and questionnaires, one interpretation seems to be that the program has produced definite interior changes in student attitudes in that they are trying harder to become better classroom citizens, but in terms of actual performance they are no different from the controls. Another interpretation of these findings, however, seems more plausible.

Improvement in personal and social development in terms of report card ratings is a factor more of the community and school situation than the program itself. As teacher questionnaires and principal questionnaires indicated, by the end of eighth grade most schools were experiencing success with the program; some, in fact, claimed it was the best guidance device they had encountered in recent years. On the other hand, in those instances in which the schools had negative experiences, student morale in experimental classes had declined; teacher and student rejection of the program were exhibited in poor student behavior and self-control. In the analysis, however, all schools were included. The more frequent negative ratings given experimental students in these few schools tended to diminish the results shown in the overall picture. This explanation is also suitable for interpreting the attendance results.

4. What were some of the factors making for program success in one school and failure in another school?

A review of the responses from questionnaires and the evidence of statistical analysis indicate the following contributing factors to program success. First, a school located in a Puerto Rican or Spanish-speaking area whose residents are mainly new arrivals or less than one generation in the area tends to find more favorable reaction to the idea of bilingual education. Second, a school staffed by a fluent, Spanish-speaking teacher experiences more success than one in which an alternate staffing system is used. Third, an orientation program that explains the aims and secures the cooperation of community, school staff and students, rewards the students with a successful program. Fourth, the implementation of the program in schools whose staffs and parents are optimistic about the possibilities of bilingual education results in a psychological climate which prevents the extra chores germane to such a program from diminishing motivation. Fifth, flexibility in the adoption of material to student needs. It was found that there was almost unanimous praise for the curriculum material developed by the project staff, whereas little value was accorded the special textbooks. Sixth, proper screening of pupils for inclusion in the program. Although rigorous standards were established for student entrance into the program, it was felt that the subjective nature of some of these criteria, particularly with reference to determining Spanish language ability, resulted, in some cases, in classes composed of too many students whose knowledge of Spanish was not sufficient for the experience as presented. Classes with average bilingual dominance ratings of 18 or higher tended to more receptive to this type experience. Seventh, a well-knit working unit consisting of principal, supervisors and teachers within the school with frequent communication for guidance from the project staff resulted in the early identification and remediation of difficult administrative and instructional problems.

5. What effects did the program have upon student anxiety?

In the cases of both general anxiety and test anxiety it was found that the program had effected definite decreases in anxiety among experimental children. The program for most children was a rewarding psychological experience.

6. What effects did the program have upon student attitudes toward the culture of the parents?

Evaluation revealed that the bilingually taught children tended to retain the parental culture more than do the conventionally taught children. This was an aim of the program, based upon the assumption that rejection of the parental culture was too frequently related to rejection of the home itself. In areas where negative forces quickly absorb the interest of rootless children, it was felt that any increase in the bond between home and child would be desirable. Since the program had the effect of significantly increasing the degree to which bilingually taught children retain the culture of the parents, it is felt that the program strengthened the bond between child and home. It is however, important to note that this degree of difference between experimentals and controls is not so great that the program could be accused of causing another fracture within the commonweal by creating an additional sub-culture. Present results do not seem to substantiate such an allegation.

CHAPTER VI

RECOMMENDATIONS

The problem of hastening the effective school adjustment of the in-migrant student while preserving his potential for future academic success has many facets. We know that at the early stages of a school career a student develops attitudes toward himself and his work which serve as the springboard for future school effort. These attitudes are at least as important as the academic knowledges and skills he may accumulate. On the other hand, a program which overemphasizes its effort to create positive attitudes and thereby neglects the basic academic skills can lead only to student disillusionment.

Traditionally, the nurturing of pride in self and family has been among the stated aims of the educational program for newly arrived students. However, the practical demonstration of this purpose in terms of the use of the student's background language as a medium of instruction was avoided. It was theorized that such use of foreign language would hinder the student in his progress toward mastering English. It was further feared that encouraged use of a native tongue might lead to a chauvinistic isolation and a political "balkanization" of foreign language groups. Foreign language maintenance, with all its potential for accelerating student progress and preserving home-school contact, has been neglected.

The problem now confronting our educators is one of developing methods of instruction which would accelerate learning on the total front of curriculum areas while preserving the student's skill in his background language and nurturing the pride which stems from his familial associations. An approach toward the resolution of this problem in New York City is incorporated in the following recommendations:

1. Encourage the organization of classes consisting of seventh grade junior high school students who have a common foreign language background. Provide these students with bilingual instruction in one selected major subject for three consecutive years.

This recommendation assumes the presence of a teacher who is licensed in the subject area being taught and who is fluent or near fluent in the student's background language. The target population should consist of students who have already mastered the fundamentals of English (no more than two years retarded on a standardized reading test) and who have maintained, to this point, an ability to understand and speak their own background language. It also presumes that departmentalization and parallel scheduling of classes would permit students to be in integrated classes with native speakers of English for the largest part of the school day.

2. Provide an intensive foreign language maintenance course for students of foreign language background. The depth course would be aimed at developing a high level of literacy in the foreign language.

This recommendation assumes the availability of a highly proficient Spanish language teacher, preferably a native speaker. The design of the course would include formal grammar, composition and the basic elements of contrastive language study. The sequence of study should continue through a planned course extending over a period of at least six years. Purchase of suitable text material for the advanced levels of work would require the attention of a qualified program committee.

3. Establish a coordinator of Bilingual Study within the Curriculum Bureau or Foreign Language Department, who might serve to assist the local superintendents in their efforts to organize effective programs of bilingual instruction in their own districts.

An effective bilingual program can operate only when certain essential elements are present; students must be reasonably homogeneous with respect to language ability; teachers must be adequately prepared in both content area, foreign language and methods of bilingual instruction; instructional materials must be complete and organized in a sequential and graded fashion; supervision and administration of the program must be in the hands of competent and creative persons. A brief guide should be prepared to detail the essential contingencies for the establishment of a demonstration class in voluntary districts (student population, teacher selection, program to be followed, procedures with parents evaluation, articulation and reversibility to normal course).

4. Continue the policy of encouraging bilingualism and biculturalism in the city schools. Concerning the use of Spanish, this study indicates the following guiding principles:

a. The task of developing competence in English language skills will always remain the focal point of our instructional efforts.

b. Developing and maintaining a student's proficiency in his own background language can enhance his present academic progress and can equip him with a skill which will be highly prized in both the commercial and academic worlds. Continued growth in English is in no way diminished by a program involving the limited and controlled use of Spanish as a medium of instruction.

c. The controlled use of Spanish within the schools instructional program helps to raise the student's self-image, morals and aspirations by nurturing his pride in his Spanish origins.

d. The legitimate use of Spanish helps to create in the student an appreciation of the fact that American democracy does not require sterile cultural uniformity.

e. The limited use of the Spanish language by students who have already mastered the basic skills in English should serve "--- as leverage for educational adjustment and achievement rather than as a defect in the process of acclimation to an alien culture."

f. The development of a cadre of well educated truly bilingual graduates is essential for the implementation of our nation's expanding economic and political programs in South America.

g. Student involvement in a school program for the development and maintenance of Spanish language skills should operate on a voluntary basis and should assist in drawing parents into an integrated effort to advance student school achievement.

5. The creation of a special teaching license which would indicate teacher competence in both a subject area and a foreign language.

Certification would be based upon applicants success in a formal examination devised by the Board of Examiners. It is essential to consider that large numbers of highly qualified teachers who have not taken the standard sequence of pedagogical courses can be found in the ranks of recently arrived professional personnel from Puerto Rico, Cuba and Latin America. Competence in English, in these cases, becomes the point of concern for our schools. The small number of prospective candidates would militate against the formal institution of specific course requirements.

6. Further research should be conducted in order to determine the educational and psychological effects of bilingual instruction upon students in the elementary and high school years.

Suitable areas of research would include analyses of effects of bilingualism upon students who recently arrived as well as upon second generation Americans who have retained an understanding of their background language. The experimental variable may be delimited so that it considers only an intense course in the foreign language or it may be extended to include bilingual instruction during more than one programmed time block.

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APPENDIX A

LIST OF SCHOOLS AND PERSONNEL IN SCIENCE-SPANISH PROGRAM

SCIENCE-SPANISH RESEARCH PROJECT

Bureau of Educational Research

130 West 55th Street
New York, N. Y. 10019

The personnel listed below are presently involved in the Science-Spanish project as of November, 1964. As a result of reassignments and school reorganization it may be expected that some changes will take place during the school year 1964-65.

School	Address Tel. No.	Sup't. Prin.	A.P. Sci. Tchr.	Spanish Tchr. N. E. Coord.
J 38X	701 St. Ann's Ave. -55 ME 5-9950	J. C. Cocks I. Littwin	B. Abramson J. Fonseca	E. Fink J. Mateu
J 52X	681 Kelly St. -55 WY 3-1250	J. C. Cocks R. May	D. Fraser A. Rodriguez	G. Parker L. Cruz
J 118X	577 E. 179 St. -57 FO 5-0500	C. Shapp M. Sablove	H. Precourt M. Berkowitz	R. Baker H. Kramer
J 136X	750 Jennings St. -59 DA 9-8700	E. Maleska R. F. Greenberg	L. Summergrad A. Rivera	A. Cohen A. Perez
J 139X	345 Brook Ave. -54 MO 5-8448	J. C. Cocks P. Weinstein	I. Kohn Mrs. Gill	Miss Middleton Mrs. Elliot
J 12M	371 Madison St. -2 OR 3-5770	F. Becker H. Seidman	M. Nestler A. Cohen	A. Cohen Miss Andricos
J 13M	Madison Ave. & 106 St. -29 CI 6-4196	M. Clark L. Loeb	C. Symon S. Nunes	A. Soneira C. Symon
J 22M	111 Columbia St. -2 OR 7-5190	F. S. Becker E. Zeitlin	N. Levine M. Rodriguez	D. O'gano A. Bloom
J 44M	100 W. 77th St. -24 SU 7-1424	M. C. Finkel S. Cohen	R. Harrison R. Douglas	J. Noriega V. DeFeo
J 71M	600 E. 6th St. -9 OR 3-6510	F. S. Becker J. Landman	B. Rappaport Mrs. Carreras	Miss Rapp Mrs. Hanson
J 99M	410 E. 100th St. -29 EN 9-3130	E. Scalea M. Decessare	F. Maralian J. Orna	O. Guadalupe F. Schaeffer
J 117M	230 E 109th St. -29 SA 2-5000	M. Clark I. S. Flax	A. Moskowitz L. Torres	Miss Smith C. DelSol
J 118M	154 W. 93rd St. -25 RI 9-0291	M. C. Finkel E. Gaines	I. Cohen L. Torres	A. Ruiz B. Detoro

School	Address Tel. No.	Sup't. Prin.	A.P. Sci. Tchr.	Spanish Tchr. N.E. Coord.
J 33K	70 Tompkins Ave. -6 ST 2-1576	E. V. Crowley S. Klevorick	J. Zuckerman J. Calero	J. Calero
J 49K	223 Graham Ave. -6 EV 7-0637	A. I. Jaffe J. Devine	M. Silver M. Madison	C. Gonzalez B. Park
J 136K	4004-4th Ave. -32 ST 8-2442	J. W. McCarthy A. Ferrerio	C. LaRussa E. Liden	R. Rios I. Hernandez
J 263K	210 Chester St. -12 HY 8-6780	M. Meyers I. Robbins	A. Dembo D. Jaffee	D. Zopata S. Laitman
J 265K	101 Park Ave. -5 UL 8-2726	M. Mehlman B. Fox	W. Greenberg V. Foley	B. Greco M. Mermelstein

APPENDIX B

BILINGUAL BASIC TEST OF SCIENCE KNOWLEDGE

BOARD OF EDUCATION
SCIENCE SPANISH EXPERIMENT

Spanish & English

PN 2370
1500-10-64

SCIENCE TEST

Grades 5 & 6

Sample questions:

100. The best way to travel on water is by

a. airplane.
b. boat.
c. bus.
d. train.

101. We hear with our

a. eyes.
b. teeth
c. nose.
d. ears.

PRUEBA DE CIENCIAS

Grados 5 y 6

Ejemplos:

100. La mejor manera de viajar por agua es en

a. aeroplano.
b. bote.
c. autobus.
d. tren.

101. Nosotros oímos con

a. los ojos.
b. los dientes.
c. La nariz.
d. los oídos.

Translated by

Carmen S. Sanguinetti, Ed. D.

Original Test is a Research Product of:

The New York City Study of Closed Circuit Television
Cooperative Research Project of the Fund for the
Advancement of Education and the Board of Education of N.Y.C.

1. Juanita jugaba afuera un día de verano. De repente llovió y Juanita se mojó. Para proteger su salud, Juanita debió

   a. venir a la casa y cambiarse de ropa.
   b. seguir jugando y dejar que el sol secara su ropa.
   c. dejar de jugar y acostarse al sol.
   d. venir a la casa y permanecer en cama.

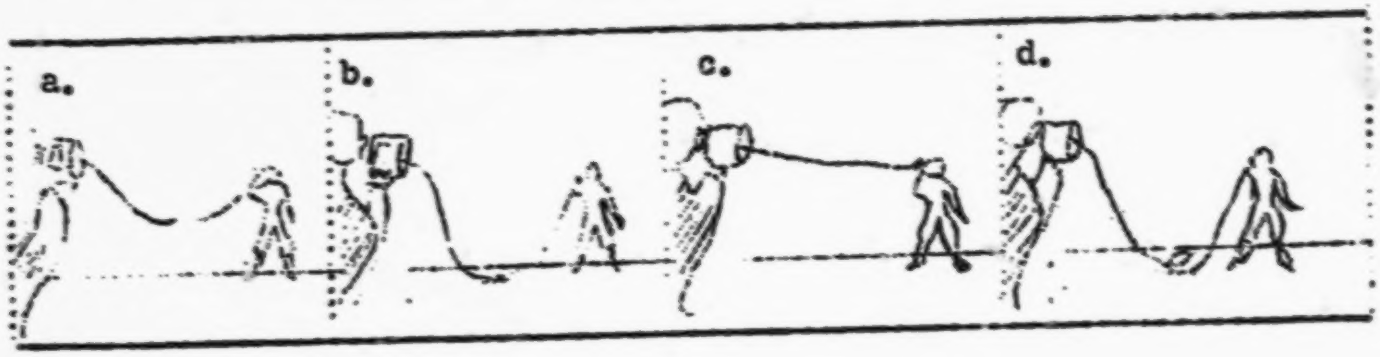
2. La serpiente cascabel es muy peligrosa porque

   a. propaga enfermedades.
   b. lleva un cascabel en la cola.
   c. su mordida es venenosa.
   d. destruye las cosechas.

3. ¿Cuál de los siguientes alimentos ayuda más a crecer?

   a. Azúcar.
   b. Carne.
   c. Melón.
   d. Aceite de oliva.

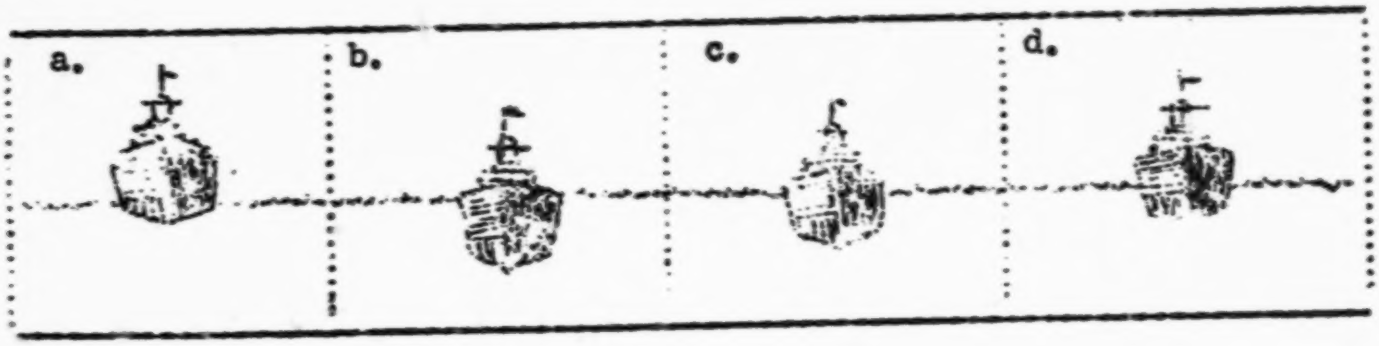
4. Roberto y Guillermo construyeron un teléfono de hilo. Ellos trataron varias maneras de usarlo. ¿Cuál de los dibujos muestra el mejor método?



5. La Tierra es

   a. una estrella.
   b. un cometa.
   c. un meteoro.
   d. un planeta.

6. Este dibujo muestra cuatro barcos. Todos los barcos son iguales pero llevan cargas distintas. ¿Cuál de los barcos lleva la carga mas pesada?



1. Carol was playing outside one summer day. She was caught in a shower and got wet. In order to do the best thing for her health, Carol should

   a. go inside and change her clothes.
   b. continue playing and let the sun dry her clothes.
   c. stop playing and lie in the sun.
   d. go inside and go to bed.

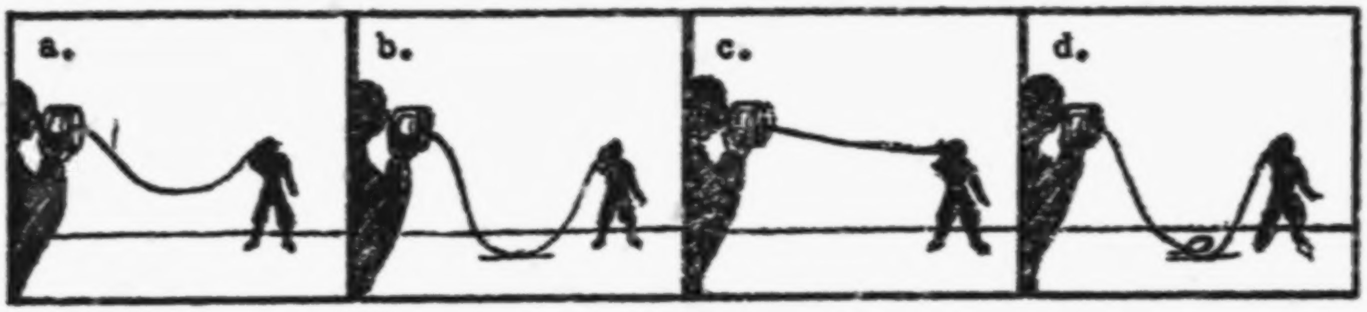
2. Rattlesnakes are dangerous because they

   a. spread disease.
   b. have rattles on their tails.
   c. have a poisonous bite.
   d. destroy crops.

3. Which of the following foods does the most to make your body grow?

   a. Sugar.
   b. Meat.
   c. Melon.
   d. Olive oil.

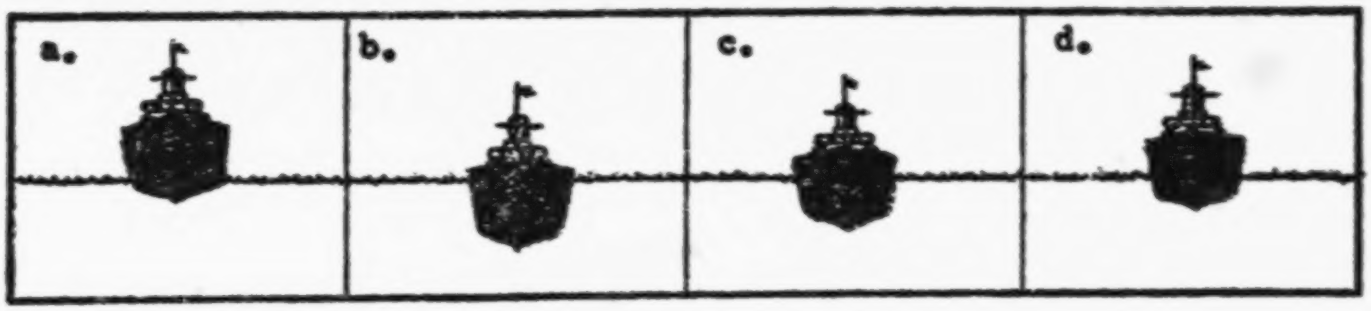
4. Bob and Bill made a string telephone. They tried many different ways of using it. Which picture shows the way that worked best?



5. The earth is a

   a. star.
   b. comet.
   c. meteor.
   d. planet.

6. This is a picture of four ships. They are just alike except that they are carrying different loads. Which ship has the heaviest load?



7. Cuando se transportan frutas y vegetales por tren desde la hacienda a ciudades distantes, las frutas y vegetales se mantienen frescas en los

a. coches-comedores.
b. coches-camas.
c. coches de refrigeración.
d. coches de observación.

8. Los pájaros son beneficiosos porque

a. pelean con las ardillas.
b. comen insectos que destruyen las cosechas.
c. almacenan nueces para el invierno.
d. hacen nidos en los árboles.

9. En una noche de una densa neblina un avión volaba en lo alto sobre la casa de Jaime. Él supo esto porque

a. vió el avión.
b. sintió el calor que producía.
c. sintió el viento que producía.
d. oyó el ruído que producía.

10. La parte del cuerpo que más vibra para producir los sonidos cuando hablamos, está en

a. la garganta.
b. la nariz.
c. las mejillas.
d. el cráneo.

11. ¿Cuál de siguientes materiales hara el mejor bote para usarlo en el estudio de la ciencias?

a. Un pedazo de papel.
b. Un pedazo de madera.
c. Un pedazo de tubería de plomo.
d. Un pedazo de tela.

12. En casa de María, las luces, la plancha y el radio estaban todos prendidos. Entonces María prendió la televisión y todas las luces se apagaron. Las luces se apagaron porque la corriente eléctrica se interrumpió en

a. el filamento.
b. el zócalo.
c. la bombilla.
d. el fusible.

13. Si los petirrojos no volaran hacia el sur antes de venir el invierno, muchos de ellos morirían porque no podrían obtener suficiente (s)

a. materiales para sus nidos.
b. agua.
c. sol.
d. alimento.

7. When fruits and vegetables are shipped by railroad from farms to distant cities, they are kept fresh in

   a. dining cars.
   b. pullman cars.
   c. refrigerated cars.
   d. observation cars.

8. Birds help us because they

   a. fight with squirrels.
   b. eat insects that destroy crops.
   c. store nuts for winter.
   d. make nests in trees.

9. One night during a heavy fog, a jet plane was flying high above Jim's house. He knew it was there because he

   a. saw it.
   b. felt the heat it gave off.
   c. felt the wind it made.
   d. heard it.

10. The part of your body that vibrates most to make the sound when you speak is located in your

    a. throat.
    b. nose.
    c. cheeks.
    d. skull.

11. Which of the following things would make the best boat for you to use in studying science?

    a. A piece of paper.
    b. A piece of wood.
    c. A piece of lead pipe.
    d. A piece of cloth.

12. In Mary's house the electric iron, the radio, and all the lights were on. Then Mary turned on the television, and all the lights went out. They went out because the electric current was cut off at the

    a. filament.
    b. socket.
    c. bulb.
    d. fuse.

13. If robins did not fly south before winter, most of them would die because they could not get enough

    a. things to build nests with.
    b. water.
    c. sunshine.
    d. food.

14. Juanita hizo un electroimán y quiso ver si funcionaba. La mejor manera de probarlo fué viendo si atraía

- a. bolitas de vidrio.
- b. tachuelas de hierro.
- c. centavos de cobre.
- d. gomas elásticas.

15. Cuando un piloto de avión va a aterrizar, generalmente recibe la información de

- a. la torre de control.
- b. la camarera.
- c. algunos pasajeros.
- d. los helicópteros en el aeropuerto.

16. Los hombres que vayan a la Luna necesitarán equipo especial para oirse los unos a los otros. En la Luna no se oyen los sonidos como en la Tierra porque la Luna no tiene

- a. luz.
- b. calor.
- c. agua.
- d. aire.

17. Los estudiantes notaron los escalones de piedra que conducen al parque zoológico. Los escalones estaban gastados en el centro. Probablemente esto se debió

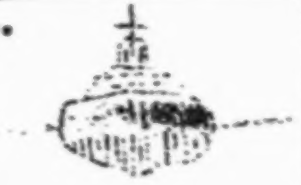
- a. a la nieve.
- b. a la neblina.
- c. al pasar de la gente.
- d. a la lluvia.

18. Jaime infló su globo de goma tanto como le fué posible y cerró la abertura apretando el pulgar contra sus otros dedos. Entonces soltó el globo en el aire. El globo

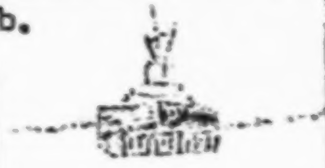
- a. explotó.
- b. subió al techo y se quedó allí.
- c. se cayó al piso.
- d. voló hacia arriba y a través del salón.

19. Este dibujo muestra cuatro botes como si pudiéramos ver bajo el agua. La línea ondulada representa la superficie del agua. ¿Cuál de los botes podrá viajar más rápidamente debido a su forma?

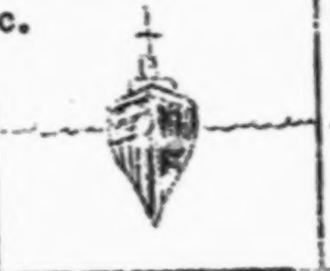
a.



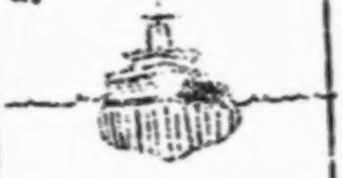
b.



c.



d.



14. Jane made an electromagnet. She wanted to see whether it worked. The best way to test it was to see if it could pick up

    a. glass marbles.
    b. iron tacks.
    c. copper pennies.
    d. rubber bands.

15. An airplane pilot usually gets the information he needs for landing his plane from

    a. the control tower.
    b. the stewardess.
    c. some of the passengers.
    d. helicopters from the airport.

16. The men who get to the moon will need special equipment to hear each other. Sound cannot be heard on the moon as it is on earth because the moon has no

    a. light.
    b. heat.
    c. water.
    d. air.

17. The pupils noticed the stone steps leading to the zoo. The steps were worn down in the middle. They had been worn down mainly by

    a. snow.
    b. fog.
    c. footsteps.
    d. rain.

18. Jim blew up his balloon as big as he could. He held the opening closed tight with his thumb and fingers. Then he let the balloon go into the air. What did the balloon do? It

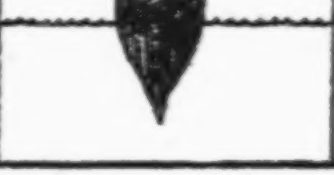
    a. burst with a bang.
    b. flew up near the ceiling and stayed there.
    c. dropped to the floor.
    d. flew up and across the room.

19. This is a picture of four ships shown as if you could see under the water. The wavy line stands for water level. Which ship has the shape that makes it travel fastest?

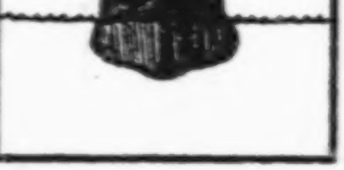
a.

b.

c.



d.



20. La clase de la Srta. Brown tiene un jardín de cactos. Los niños riegan las plantas una vez a la semana porque los cactos

a. no necesitan ninguna agua.
b. almacenan agua en sus tallos.
c. no son organismos vivientes.
d. crecen en la arena.

21. Cuando el hielo se derrite ocurre un cambio de

a. líquido a sólido.
b. gas a líquido.
c. líquido a gas.
d. sólido a líquido.

22. Las plantas verdes adquieren el agua por medio de

a. las raíces.
b. las hojas.
c. el tallo.
d. las flores.

23. Utilizamos la luz cuando

a. prendemos el abanico eléctrico.
b. tomamos una fotografía con una cámara.
c. oímos un disco en el fonógrafo.
d. cocinamos alimentos en la estufa.

24. Roberto y su padre visitaron el aeropuerto. Había muchas clases de aeronaves. Una subió derecho hacia arriba sin correr a lo largo de la pista. Esta aeronave era un

a. avión de propulsión.
b. aeroplano.
c. dirigible.
d. helicóptero.

25. Las predicciones del tiempo se hacen mayormente de mapas que se preparan

a. cada día.
b. cada semana.
c. cada dos semanas.
d. cada mes.

26. La lluvia corría colina abajo hacia el lago en el parque. El lago se puso turbio porque el agua llevaba

a. polvo del aire.
b. suelo pulverizado.
c. piedras de la colina.
d. tallos de color oscuro, hojas y flores.

20. Miss Brown's class has a cactus garden. The children water it once a week because cactus plants

    a. do not need any water.
    b. can store water in their stems.
    c. are not really living.
    d. grow in sand.

21. When ice melts we see a change from a

    a. liquid to a solid.
    b. gas to a liquid.
    c. liquid to a gas.
    d. solid to a liquid.

22. A green plant drinks water through its

    a. roots.
    b. leaves.
    c. stem.
    d. flower.

23. Light is used when you

    a. turn on an electric fan.
    b. take a picture with a camera.
    c. play a record on the phonograph.
    d. cook food on the stove.

24. Bob and his father went to visit an airport. There were many different kinds of airplanes. One plane rose straight in the air without rolling down the runway. This plane was a

    a. jet.
    b. airliner.
    c. dirigible.
    d. helicopter.

25. Most weather forecasts are made from maps that are prepared

    a. every day.
    b. every week.
    c. every two weeks.
    d. every month.

26. Rain water ran down the side of the hill and into the lake in the park. The lake water turned brown because the rain water had carried into the lake

    a. dust from the air.
    b. top soil from the ground.
    c. rocks from the hillside.
    d. brown twigs, leaves, and flowers.

27. La Srta. Smith conectó una batería, un timbre, y un interruptor de la corriente (switch). Cuando se cerraba el "switch", el timbre sonaba. Esto demuestra que la electricidad pasaba por

a. el escritorio de madera.
b. el aire.
c. la cubierta del alambre.
d. el circuíto de alambre.

28. La mejor manera de llegar a la luna es en un cohete porque

a. nunca se descompone la máquina.
b. no puede estrellarse.
c. no necesita aire para soportarlo.
d. no necesita combustible.

29. El reportero del tiempo le dijo a Juan que él hace las predicciones del tiempo después de consultar los informes de

a. temperatura y presión.
b. vientos y humedad.
c. ninguno de éstos.
d. todos éstos.

30. Cuando la temperatura de las nubes es menos que el punto de congelación del agua, puede haber

a. neblina.
b. nieve.
c. lluvia.
d. rocío.

31. Juan compitió en las carreras inmediatamente después de clase. Cuando terminó la carrera, Juan estaba sediento. Cuidando de hacer lo mejor para su salud, Juan tomó un poco de agua fresca

a. inmediatamente después de la carrera.
b. a la hora de acostarse.
c. diez minutos después de la carrera.
d. dos horas después de la carrera.

32. El agua se cambia a vapor porque el calor hace que las moléculas

a. se muevan más rápidamente.
b. cesen de moverse.
c. se pongan más grandes.
d. se muevan más despacio.

33. La electricidad que se usa en tu escuela se produce en

a. el cuarto de la caldera.
b. una factoría.
c. una estación del ferrocarril subterráneo (subway).
d. la planta central.

27. Miss Jones connected a battery, a bell, and a switch. When she closed the switch, the bell rang. This showed that the electricity traveled in the

a. wooden desk.
b. air.
c. covering of the wire.
d. wire circuit.

28. A rocket is the best way to reach the moon because it

a. never has engine trouble.
b. cannot crash.
c. does not need air to support it.
d. does not need fuel.

29. The weatherman told Joe that he made the weather forecasts after he had studied the reports of

a. temperature and pressure.
b. winds and moisture.
c. none of these.
d. all of these.

30. When the temperature of clouds falls below the freezing point of water, there may be

a. fog.
b. snow.
c. rain.
d. dew.

31. John was in a race right after school. When the race was over, he was thirsty. He did the best thing for his health by drinking some cool water

a. right after the race.
b. at bed time.
c. ten minutes after the race.
d. two hours after the race.

32. Water changes to steam because the heat makes the molecules

a. move faster.
b. stop moving.
c. grow larger.
d. move more slowly.

33. The electricity used in your school is made in

a. the school boiler room.
b. a factory.
c. a subway station.
d. a powerhouse.

34. Las papilas del gusto se encuentran en

a. las mejillas.
b. la lengua.
c. las encías.
d. los dientes.

35. Un avión que está volando obtiene la informacion del tiempo por medio de

a. señales de humo.
b. mensajes telegráficos.
c. mensajes telefónicos.
d. radio.

36. ¿Cuál de los siguientes animales es un mamífero?

a. Oso.
b. Rana.
c. Pez dorado.
d. Mariposa

37. Podemos ver la Luna porque

a. sus explosiones atómicas la hacen brillar.
b. refleja luz del sol.
c. refleja luz de la Tierra.
d. refleja su propia luz.

38. El piloto de un avión puede determinar la altura a que está volando por medio del

a. velocímetro.
b. compás.
c. altímetro.
d. tacómetro.

39. Juan tenía dos tambores, uno al lado del otro. Juan puso una bola de papel en un tambor y golpeó el otro haciéndolo vibrar. La bola de papel

a. se quedó quieta en el tambor.
b. se cayó del tambor.
c. se rodó hacia el lado izquierdo del tambor.
d. saltaba para arriba y para abajo en el tambor.

40. ¿Cuál de las siguientes es característica de los mamíferos?

a. Pelos en la piel.
b. Temperatura más o menos constante.
c. Dientes afilados
d. Agallas.

34. The taste buds are located in your

a. cheeks.
b. tongue.
c. gums.
d. teeth.

35. A plane flying in the air gets its weather information by

a. smoke signals.
b. telegraph.
c. telephone.
d. radio.

36. Which of the following animals is a mammal?

a. Bear.
b. Frog.
c. Goldfish.
d. Butterfly.

37. We can see the moon because it

a. glows from its own atomic explosions.
b. reflects light from the sun.
c. reflects light from the earth.
d. gives its own light.

38. The pilot of an airplane can tell how high his plane is flying by looking at his

a. air speed indicator.
b. compass.
c. altimeter.
d. tachometer.

39. John had two drums. They were standing next to each other. He put a small ball of paper on one drum and hit the other drum. What happened to the ball of paper?

a. It stayed still on the drum.
b. It rolled off the drum.
c. It rolled to the left side of the drum.
d. It jumped up and down on the drum.

40. Which of the following do all mammals have?

a. Fur.
b. Warm blood.
c. Sharp teeth.
d. Gills.

41. Juanita cubrió una planta viva con una bolsa plástica dejando solamente las hojas descubiertas. Así cubierta, Juanita puso la planta en una caja que tapó con un cuadro de vidrio. Al otro día Juanita notó que la superficie interior del vidrio estaba húmeda. El agua salió de

a. el vidrio.
b. la tierra que rodeaba la planta.
c. las hojas de la planta.
d. la bolsa plástica.

42. La Srta. Smith estaba explicando la diferencia entre la Tierra y las estrellas. Una diferencia es que la Tierra

a. está más lejos del sol.
b. produce su propia luz.
c. es más grande que las estrellas.
d. se mueve alrededor del sol.

43. Pedro hizo un experimento con dos envases de lata. Pedro frotó una de las latas con papel de lija hasta que le sacó la cubierta de estaño. La otra lata no la lijó. Pedro luego puso las dos latas a la intemperie por dos semanas. A las dos semanas Pedro observó las latas y notó oxidación (moho) en

a. la lata que perdió la cubierta de estaño.
b. ambas latas.
c. ninguna de las latas.
d. la lata que mantuvo su cubierta de estaño.

44. José y Juanita ovservaron las agujas de ocho compases. Cada aguja consistía de

a. un alambre de cobre.
b. un pequeño resorte.
c. un pequeño imán.
d. un alambre de estaño.

45. Es muy importante cuidar de nuestros ojos. Una buena práctica es

a. frotarse los ojos cuando uno se despierta.
b. sentarse tan cerca del televisor que podamos alcanzarlo.
c. usar cualquier luz para leer.
d. examinarse los ojos regularmente.

46. Juan llevó a cabo un experimento. El agitó una mezcla de aceite y agua en un frasco de cristal, con tapa, por espacio de un minuto. Luego lo dejó permanecer quieto por unos minutos. Juan notó que el aceite

a. se mezcló con el agua formando una solución clara.
b. flotaba en la suferficie del agua.
c. se fué al fondo del frasco.
d. formó una capa dura.

47. Las estrellas que podemos ver reciben su luz de

a. ellas mismas.
b. el espacio.
c. nuestro sol.
d. los planetas.

41. Joan put a living plant into a plastic bag that covered all the plant except its leaves. Then she put the plant with its covering into a box and covered the box with a pane of glass. The next day she found that the under side of the glass was wet. The water had come from the

    a. pane of glass.
    b. earth around the plant.
    c. leaves of the plant.
    d. plastic bag.

42. Miss Jones was telling about the ways in which the earth is different from the stars. One difference is that the earth

    a. is farther from the sun.
    b. makes its own light.
    c. is larger than the stars.
    d. moves in a path around the sun.

43. Pedro tried an experiment with two cans. He rubbed one can with sandpaper until all its thin coat of tin was rubbed off. He left the tin covering on the second can. He put both cans outdoors for two weeks. Then he looked at the cans. He saw that rust had formed on

    a. the can with the tin coat rubbed off.
    b. both cans.
    c. neither of the cans.
    d. the can that still had its tin covering.

44. Joe and Jane studied eight compass needles. Every needle was

    a. a copper wire.
    b. a small spring.
    c. a small magnet.
    d. a tin wire.

45. It is important to take care of our eyes. A good rule is to

    a. rub your eyes when you wake up.
    b. sit so close to the TV that you can touch it.
    c. read in any kind of light.
    d. have your eyes checked regularly.

46. Joe tried an experiment. He shook oil and water in a closed glass jar for a minute, and then let the jar stand. After a few minutes, he found that the oil

    a. had mixed with the water into a clear solution.
    b. was floating on top of the water.
    c. had sunk to the bottom of the jar.
    d. had formed a hard layer.

47. The stars that you can see get their light from

    a. themselves.
    b. outer space.
    c. our sun.
    d. the planets.

48. Las substancias en las cuales las moléculas son más difíciles de separar por estar más fuertemente unidas son

a. los líquidos.
b. los gases.
c. los sólidos.
d. mezclas de estos tres.

49. Un ejemplo de un compuesto es

a. anhídrido carbónico.
b. oxígeno.
c. agua de mar.
d. azufre.

50. Las ropas mojadas que se cuelgan al aire se secan mejor en un dia

a. de viento y frío.
b. frío sin viento.
c. caliente y ventoso.
d. caliente sin viento.

51. Un generador produce electricidad girando un rollo de alambre entre

a. los polos de un imán.
b. tubos de hierro.
c. ruedas de cobre.
e. dos baterías.

52. La clase de Juan visitó el negociado del tiempo. Mientras estaban allí, se recibio un informe acerca de un huracán. El huracán empezó a formarse en

a. las Montañas Rocallosas.
b. los Grandes Llanos.
c. el Golfo de Méjico.
d. el Polo Norte.

53. Un cambio químico ocurre cuando

a. se forma nieve.
b. el carbón se quema.
c. el hielo se derrite.
d. el viento sopla.

54. Un ejemplo de nave aérea que es más liviana que el aire es un

a. cometa.
b. helicóptero.
c. avión de reacción ("jet").
d. dirigible.

48. The kind of substance that is hardest to pull apart because the molecules are held together tightest is

a. liquid.
b. gas.
c. solid.
d. mixture of all three.

49. An example of a compound is

a. carbon dioxide.
b. oxygen.
c. sea water.
d. sulphur.

50. Wet clothes hanging on a line dry best on days that are

a. cool and windy.
b. cool and not windy.
c. warm and windy.
d. warm and not windy.

51. A generator makes electricity because a coil of wire turns between

a. poles of magnets.
b. iron pipes.
c. copper wheels.
d. battery boxes.

52. Joe's class visited the weather bureau. While they were there, a report came in about a hurricane. The hurricane had started near the

a. Rocky Mountains.
b. Great Plains.
c. Gulf of Mexico.
d. North Pole.

53. A chemical change takes place when

a. snow forms.
b. coal burns.
c. ice melts.
d. winds blow.

54. An example of aircraft that is lighter than air is a

a. rocket.
b. helicopter.
c. jet plane.
d. dirigible.

55. Había una yerba espesa en la cumbre de la montaña, pero no había ninguna en la ladera. Probablemente esto se debió a que

a. el suelo superficial había sido removido por la erosión.
b. los animales se comieron la yerba de la ladera.
c. la yerba nunca crece en la montaña.
d. el sol mató la yerba.

56. Las moléculas están más separadas en

a. un trozo de carbón.
b. una botella de aire.
c. un vaso de agua.
d. una pastilla de jabón.

57. Los anfibios son beneficiosos porque

a. comen insectos que nos pican.
b. protegen las cosechas.
c. mantienen el agua limpia.
d. producen sonidos que nos avisan cuando hay peligro.

58. ¿Cuánto se tarda la Luna en dar la vuelta a la Tierra?

a. Un día.
b. Una semana.
c. Un mes.
d. Un año.

59. La lluvia se forma cuando el aire caliente sube y el vapor de agua que contiene

a. se enfría y se condensa.
b. se calienta y se condensa.
c. se calienta y se evapora.
d. se enfría y se evapora.

60. El reportero del tiempo le dijo a la clase que muchos de los vientos que azotan la ciudad de Nueva York vienen del

a. Norte.
b. Este.
c. Sur.
d. Oeste.

61. La electricidad del relámpago es de la misma clase que la que

a. se usa en una batería.
b. se usa para correr un motor.
c. se produce frotando los pies contra la alfombra.
d. se usa en la televisión.

62. El carbón que utilizamos hoy se formó muchos años atrás. Se formó de

a. rocas.
b. plantas.
c. pequeños animales marinos.
d. grandes animales terrestres.

55. There was thick grass on the flat top of a hill, but none on the hillside. The reason was probably that

    a. the top soil had been removed by erosion.
    b. animals had eaten the grass of the hillside.
    c. grass never grows on hillsides.
    d. the sun had killed the grass.

56. The molecules are scattered farthest apart in a

    a. lump of coal.
    b. bottle of air.
    c. glass of water.
    d. cake of soap.

57. Amphibians are helpful to us because they

    a. eat insects that bite us.
    b. protect our crops.
    c. keep our water clean.
    d. make sounds to tell us of danger.

58. How long does it take the moon to move around the earth?

    a. One day.
    b. One week.
    c. One month.
    d. One year.

59. Rain is formed when warm air rises and its water vapor

    a. gets cool and condenses.
    b. gets warm and condenses.
    c. gets warm and evaporates.
    d. gets cool and evaporates.

60. The weatherman told the class that most of the winds that blow into New York City come from the

    a. North.
    b. East.
    c. South.
    d. West.

61. The electricity in lightning is of the same kind as that

    a. used in a battery.
    b. used to run a motor.
    c. made by rubbing your feet on a rug.
    d. connected to a television set.

62. Coal was formed long ago out of

    a. rocks.
    b. plants.
    c. tiny sea animals.
    d. large land animals.

APPENDIX C

BILINGUAL SCIENCE TEST 7 AND 8

SCIENCE-SPANISH RESEARCH PROGRAM
130 West 55th Street
New York City, New York

BILINGUAL - EXAMINATION

1964 - 65

SCIENCE TEST in SPANISH	PRUEBA DE CIENCIAS en ESPANOL
SEVENTH GRADE	SEPTIMO GRADO
GENERAL SCIENCE	CIENCIAS GENERALES

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May 1965

NEW YORK CITY-BOARD OF EDUCATION
SCIENCE-SPANISH PROJECT
JUNIOR HIGH SCHOOL DIVISION

Sección Química   Grado 7   Pág. ________

Direcciones: En el espacio de la izquierda, escribe la letra de la contestación correcta.

1. ¿Cuál de las propiedades siguientes debe usarse muy raras veces, debido al peligro envuelto?
   - a) estado
   - b) color
   - c) gusto
   - d) lustre

2. Una substancia se clasifica como una mezcla cuando
   - a) es un gas
   - b) consiste de varias substancias que pueden variar en cantidad.
   - c) consiste de elementos en proporciones definidas y que han perdido sus propiedades.
   - d) es de color oscuro

3. Un elemento que tiene brillo y es maleable, es generalmente considerado como
   - a) metálico
   - b) metal
   - c) gas
   - d) líquido

4. Podemos obtener oxígeno de
   - a) agua
   - b) calor
   - c) hidrógeno
   - d) hierro

5. Un gas de color verde es el
   - a) hidrógeno
   - b) nitrógeno
   - c) bióxido de carbono
   - d) cloro

6. Cuando quemamos viruta de hierro en presencia del aire
   - a) su peso disminuye
   - b) su peso aumenta
   - c) su peso no cambia
   - d) produce bióxido de carbono

7. La carga eléctrica en un protón es
   - a) negativa
   - b) positiva
   - c) dos veces la de una electrón
   - d) dos veces la de un neutrón

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JUNIOR HIGH SCHOOL DIVISION

Section Chemistry Grade 7 Page________

Directions: On your separate answer sheet, circle the letter which corresponds to the right answer to each question.

1. Because of the possible danger involved, which of the following properties should rarely be used to identify a substance?
   a) state
   b) color
   c) taste
   d) luster

2. A substance is a mixture when
   a) it is a gas
   b) it consists of substances in varying amounts
   c) it consists of definite proportions of elements which have lost their properties
   d) it has a dark color

3. An element which has luster and malleability is generally considered to be
   a) a non-metal
   b) a metal
   c) a gas
   d) a liquid

4. Oxygen may be prepared from
   a) water
   b) heat
   c) hydrogen
   d) iron

5. A gas which is yellow-green in color is
   a) hydrogen
   b) nitrogen
   c) carbon dioxide
   d) chlorine

6. When steel wool is burned in air
   a) its weight decreases
   b) its weight increases
   c) its weight remains the same
   d) it gives off carbon dioxide

7. The electrical charge on the proton is
   a) negative
   b) positive
   c) twice the charge of an electron
   d) twice the charge of a neutron

(Continuación)

8. ¿Cuál de los siguientes artículos se usa para medir cantidades de líquidos?
   - a) cilindro graduado
   - b) vaso
   - c) tubo de ensayo
   - d) embudo

9. El número total de átomos en una molécula de CO_2 es
   - a) 1
   - b) 2
   - c) 3
   - d) 4

10. El peso de un átomo está concentrado en
   - a) los electrones
   - b) el núcleo
   - c) las órbitas
   - d) la capa exterior

11. Un flujo de electrones constituye
   - a) una corriente eléctrica
   - b) un ohmio
   - c) un voltio
   - d) un amperio

12. El número atómico de hidrógeno es
   - a) 1
   - b) 2
   - c) 3
   - d) 4

13. La parte del átomo que contiene los protones y neutrones se llama
   - a) la capa exterior
   - b) la órbita exterior
   - c) el núcleo
   - d) la base

14. Las cosas vivientes difieren de las cosas no vivientes en que las no-vivientes no
   - a) están hechas de pequeñas unidades
   - b) responden a los estímulos
   - c) se componen de varias substancias químicas
   - d) se componen de sólidos, líquidos y gases

(Continued)

8. Which item is best used to measure quantities of liquid?
   - a) graduated cylinder
   - b) beaker
   - c) test tube
   - d) funnel

9. The total number of atoms in a molecule of CO_2 is
   - a) 1
   - b) 2
   - c) 3
   - d) 4

10. The weight of an atom is concentrated in the
    - a) electrons
    - b) nucleus
    - c) outer rings
    - d) outer shell

11. The flow of electrons is called
    - a) an electric current
    - b) ohm
    - c) volt
    - d) ampere

12. The atomic number of hydrogen is
    - a) 1
    - b) 2
    - c) 3
    - d) 4

13. The part of the atom containing the protons and neutrons is known as
    - a) shell
    - b) outer ring
    - c) nucleus
    - d) base

14. Non-living things differ from living things because non-living things are not
    - a) made of smaller units
    - b) able to adjust to stimuli
    - c) made of various chemicals
    - d) made of solids, liquids and gases

(Continuación)

15. El moho del pan crece mejor en alimentos
    - a) que están en sitios calientes, húmedos y oscuros
    - b) en un jarro sin tapa
    - c) en agua
    - d) durante el invierno

16. Basándote sobre tu estudio con el microscopio, habrás llegado a la conclusión de que los organismos vivientes
    - a) están hechos de diferentes materiales
    - b) están hechos de celulas
    - c) no se asemejan unos a los otros
    - d) no tienen que llevar a cabo las mismas funciones para mantener la vida

17. La leche es importante para los niños porque
    - a) es la única fuente de hierro
    - b) se consigue con facilidad
    - c) contiene todos los nutrimentos
    - d) es la mejor fuente del complejo de vitamina B

18. Los niños que están sobre el peso normal deben rebajar
    - a) omitiendo el azúcar en la dieta
    - b) evitando el colesterol
    - c) comiendo carne dos veces al día
    - d) siguiendo las direcciones del médico

19. La solución Lugol se usa para determinar la presencia de
    a) almidón   c) proteína
    b) azúcar   d) minerales

20. La cantidad de energía que contienen los alimentos se mide en
    a) gramos   c) Calorías
    b) grados Centígrado   d) metros

21. Una diferencia entre una célula animal y una vegetal es que la célula animal no tiene
    - a) pared celular
    - b) citoplasma
    - c) membrana nuclear
    - d) membrana celular

(Continued)

15. Bread molds grow best on foods
    a) in a warm, moist, dark place
    b) in an open jar
    c) in water
    d) in water

16. From your study with the microscope, you can conclude that all living things
    a) are made of different materials
    b) are made of cells
    c) show no resemblance to each other
    d) do not have to perform the same tasks to stay alive

17. Milk helps growing boys and girls because
    a) it is our only source of iron
    b) it is easily purchased
    c) it contains all the nutrients
    d) it is our best source of vitamin B complex

18. Overweight pupils should reduce their weight by
    a) omitting sugar from their diet
    b) avoiding cholesterol
    c) eating meat twice daily
    d) following a physician's advice

19. Lugol's solution is used to test for
    a) starch c) protein
    b) sugar d) minerals

20. The energy value of foods is measured in
    a) grams c) Calories
    b) degrees Centigrade d) meters

21. One difference between an animal cell and any plant cell is the
    a) cell wall
    b) cytoplasm
    c) nuclear membrane
    d) cell membrane

(Continuación)

22. El proceso por el cual las celulas manufacturan carbohidratos del agua y gas carbónico se llama
- a) difusión
- b) ósmosis
- c) fotosíntesis
- d) digestión

23. Un tejido adaptado para llevar mensajes es
- a) el tejido nervioso
- b) el tejido epitelial
- c) el cartílago
- d) el tejido muscular

24. Unas gotas de tintura de iodo cayeron en la camisa de un niño. El iodo tornó la tela azul oscuro porque
- a) la tintura de iodo contiene alcohol
- b) la camisa tenía almidón
- c) las fibras de algodón son mayormente de celulosa
- d) la camisa se chamuscó al plancharla

25. Un estudiante trató un trozo de pan para determinar la presencia de azúcar, almidón, proteína, y grasas. Todas las pruebas dieron resultados positivos. Probablemente el estudiante estaba
- a) correcto
- b) incorrecto en varias pruebas
- c) equivocado en casi todas las pruebas
- d) equivocado en todas las pruebas excepto en la de almidón

26. La mejor manera de mostrar un estoma bajo el microscopio es usando
- a) la epidermis inferior de una hoja de begonia
- b) la piel externa de una sección de una cebolla madura
- c) una sección larga de un tallo de cebolla
- d) una sección transversal de una raíz joven

27. Los fósiles que se encuentran en rocas que tienen la misma edad se llaman
- a) moldes
- b) fósiles
- c) impresiones
- d) concreciones

28. La abertura de un volcán se llama
- a) cuello
- b) cráter
- c) hoyo
- d) desague

(Continued)

22. The process by which green plant cells manufacture carbohydrates from water and CO_2 is
    - a) diffusion
    - b) osmosis
    - c) photosynthesis
    - d) digestion

23. A tissue adapted for carrying messages is
    - a) nerve
    - b) epithelial
    - c) cartilage
    - d) muscle

24. Tincture of iodine drops fell on a boy's shirt. The shirt turned blue-black because
    - a) tincture of iodine contains alcohol
    - b) the shirt had starch in it
    - c) the cotton fibers in a shirt are mostly cellulose
    - d) the laundry had scorched the shirt

25. A student tested bread for sugar, starch, protein, and fat. All of the tests were positive. He was probably
    - a) right
    - b) mistaken on several of the tests
    - c) mistaken on most of the tests
    - d) mistaken except for starch

26. The easiest way to show a stomate under the microscope is to use the
    - a) lower epidermis of a begonia leaf
    - b) outer skin of a section of mature onion bulb
    - c) long section of an onion stem
    - d) cross section of a young root

27. Fossils found in rocks of only one age are called
    - a) casts
    - b) index fossils
    - c) imprints
    - d) concretions

28. The opening at the top of a volcano is called a
    - a) neck
    - b) crater
    - c) pothole
    - d) sinkhole

(Continuación)

29. Una corriente eléctrica es un flujo de electrones del
a) polo negativo al positivo
b) polo negativo al negativo
c) polo positivo al negativo
d) polo positivo

30. En la instalación eléctrica de la casa, los enchufes están conectados en
a) paralelo
b) serie
c) un corto circuíto
d) direcciones opuestas

31. La resistencia de un alambre de cobre es 4 ohmios. La resistencia de otro alambre del mismo grueso, pero dos veces más largo es
a) 1 ohmio
b) 2 ohmios
c) 4 ohmios
d) 8 ohmios

32. Los imanes poderosos están hechos de
a) níquel
b) cobre
c) bronce
d) alnico

33. El calor es una forma de
a) fuerza
b) potencia
c) energía
d) combustible

34. Todos los termómetros Fahrenheit tienen
a) 180° entre los puntos de congelación y ebullición del agua
b) mercurio
c) 100° entre los puntos de congelación y ebullición del agua
d) alcohol

35. La energía del sol llega a la tierra por medio de
a) radiación
b) convección
c) conducción
d) reflección

36. Cuando un cuerpo se calienta las moléculas se
a) expanden
b) contraen
c) juntan más
d) mueven más rápidamente

(Continued)

29. An electric current is a flow of electrons from
    a) minus to plus (negative to positive)
    b) minus to minus
    c) plus to minus
    d) plus to plus

30. In normal house wiring, electrical outlets are connected in
    a) a parallel circuit
    b) a series circuit
    c) a short circuit
    d) opposite directions

31. The resistance of a piece of copper wire is 4 ohms. The resistance of a second piece of copper wire of the same thickness, but twice as long is
    a) 1 ohm
    b) 2 ohms
    c) 4 ohms
    d) 8 ohms

32. Strong magnets are made of
    a) nickel
    b) copper
    c) brass
    d) alnico

33. Heat is a form of
    a) force
    b) power
    c) energy
    d) fuel

34. All Fahrenheit thermometers have
    a) 180° between freezing and boiling points of water
    b) mercury
    c) 100° between freezing and boiling points of water
    d) alcohol

35. Energy from the sun reaches the earth by
    a) radiation
    b) convection
    c) conduction
    d) reflection

36. When a body is heated the molecules
    a) expand
    b) contract
    c) move close together
    d) move faster

(Continuación)

37. Los solidos transfieren calor por el proceso de
- a) conducción
- b) convección
- c) radiación
- d) inducción

38. El estudio científico de la naturaleza de la tierra se llama
- a) ecología
- b) geología
- c) fisiología
- d) biologia

39. El diafragma de un microscopio
- a) aumenta la imagen
- b) admite la luz
- c) protege el ocular
- d) cubre el objetivo

40. El liquido que no nunca se debe evaporar cerca de la flama es
- a) el agua
- b) el alcohol
- c) una sòlucion de azúcar
- d) la leche

(Continued)

37. Solids transfer heat by the process of
    - a) conduction
    - b) convection
    - c) radiation
    - d) induction

38. The scientific study of the nature of the earth is called
    - a) ecology
    - b) geology
    - c) physiology
    - c) biology

39. The diaphragm of a microscope
    - a) enlarges the image
    - b) admits light
    - c) protects the eye piece
    - d) covers the objective lens

40. The liquid which should never be evaporated near an open flame is
    - a) water
    - b) alcohol
    - c) sugar solution
    - d) milk

SCIENCE-SPANISH RESEARCH PROGRAM
130 West 55th Street
New York 19, N. Y.

BILINGUAL EXAMINATION - II

1965 - 66

SCIENCE TEST in SPANISH	PRUEBA DE CIENCIAS en ESPANOL
EIGHTH GRADE	OCTAVO GRADO
GENERAL SCIENCE	CIENCIAS GENERALES

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PN 22-349

June 1966

NEW YORK CITY-BOARD OF EDUCATION
SCIENCE-SPANISH PROJECT

EXAMEN BILINGUE DE CIENCIAS

Direcciones: En la hoja de contestaciones, haz un círculo alrededor de la letra que corresponde a la contestación correcta en cada pregunta.

1. El tratamiento de primera ayuda para una quemadura de la piel causada por un acido consiste en lavarse primero con agua y después aplicarse

   a. sal
   b. hidróxido de sodio
   c. bicarbonato sódico
   d. lejía

2. Un producto que se produce siempre que ocurre el proceso de neutralización es

   a. una base
   b. un acido
   c. agua
   d. bicarbonato sódico

3. Disoluciones que contienen más iones H^+ que OH^-

   a. cambian el papel tornasol a azul
   b. son enutrales
   c. son ácidos
   d. son bases

4. El ión que se forma siempre que una base se ioniza es

   a. Na^+
   b. OH^-
   c. H^+
   d. Cl^+

5. Podemos neutralizar acido clorhídrico con

   a. cloruro de sodio
   b. hidróxido de sodio
   c. vinagre
   d. tornasol

6. La reacción iónica $H^+ + OH^- \dashrightarrow H_2O$ representa

   a. evaporacion
   b. oxidación
   c. reducción
   d. neutralización

7. El ión que se forma siempre que los ácidos se ionizan es

   a. Cl^-
   b. $SO_4^=$
   c. reducción
   d. neutralización

8. Los ácidos generalmente

   a. son soluciones coloradas
   b. cambian el papel tornasol de azula rojo
   c. cambian el papel tornasol de rojo a azul
   d. no reaccionan con los metales

NEW YORK CITY-BOARD OF EDUCATION
SCIENCE-SPANISH PROJECT
JUNIOR HIGH SCHOOL DIVISION

BILINGUAL SCIENCE EXAMINATION II

Directions: On your separate answer sheet, circle the letter which corresponds to the right answer to each question.

1. The first-aid treatment for an acid burn on the skin is to first wash with water and then to apply

a. salt
b. sodium hydroxide
c. sodium bicarbonate
d. lye

2. A product which always results from a neutralization reaction is

a. a base
b. an acid
c. water
d. sodium carbonate

3. Solutions which contain more H^+ than OH^- ions

a. turn litmus blue
b. are neutral
c. are acids
d. are bases

4. The ion which always forms when bases ionize is

a. Na^+
b. OH^-
c. H^+
d. Cl^+

5. Hydrochloric acid may be neutralized by

a. sodium chloride
b. sodium hydroxide
c. vinegar
d. blue litmus

6. The ionic equation $H^+ + OH^- \_\_\_ H_2O$ represents

a. evaporation
b. oxidation
c. reduction
d. neutralization

7. The ion which always forms when acids ionize is

a. Cl^-
b. $SO_4^=$
c. Na^+
d. H^+

8. Acids usually

a. are colored solutions
b. turn blue litmus red
c. turn red litmus blue
d. do not react with metals

(Continued)

9. Of the following, the substance which conducts an electric current best is

   a. dilute hydrochloric acid
   b. oil
   c. alcohol
   d. pure water

10. The boiling point of pure water

    a. is lower than salt water
    b. is higher than salt water
    c. is the same as salt water
    d. cannot be measured with a mercury thermometer

11. An example of a mixture is

    a. sodium chloride
    b. sea water
    c. oxygen
    d. water vapor

12. A crystal of salt was added to a solution of the salt. The crystal dissolved quickly. The original salt solution was

    a. concentrated
    b. saturated
    c. unsaturated
    d. supersaturated

13. A blue crystal of copper sulfate dissolved when added to a pale blue solution of copper sulfate. The original solution was most probably

    a. saturated
    b. supersaturated
    c. dilute and unsaturated
    d. dilute

14. Solutions of strong bases can be recognized because they

    a. turn blue litmus red
    b. turn phenolphthalein pink
    c. are colored solutions
    d. give off hydrogen gas when reacting with a metal

15. Distillation of sea water to form pure water depends upon

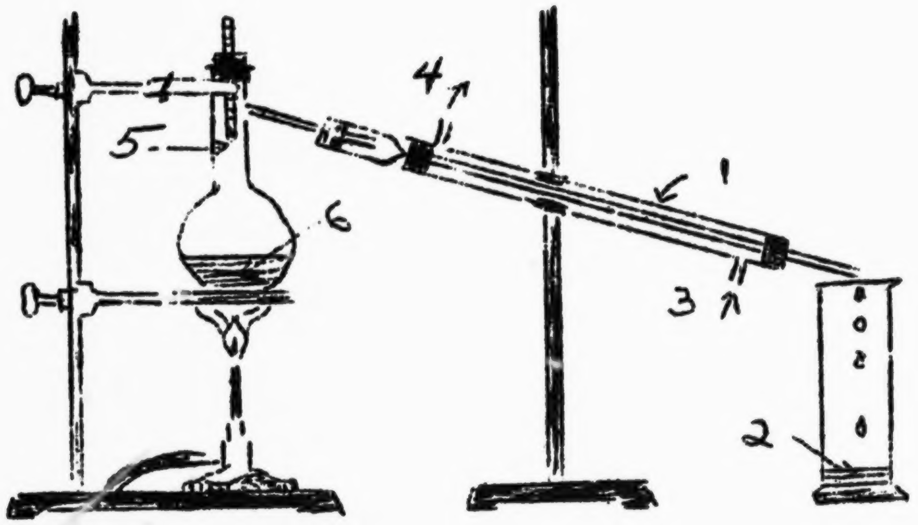
    a. evaporation
    b. condensation
    c. evaporation and condensation
    d. precipitation

16. In the fractional distillation of petroleum, gasoline distills first because

    a. gasoline has the highest boiling point
    b. gasoline has the lowest boiling point
    c. gasoline has a low kindling temperature
    d. gasoline has the highest molecular weight

(Continuación)

Las preguntas 21-24 se refieren al diagrama que aparece abajo. En la hoja de contestaciones haz un círculo alrededor de la letra que representa la mejor contestacion en cada pregunta:



17. La solución más pura del destilado se encontrará en

    a. b
    b. 5
    c. 2
    d. 1

18. El solvente purificado es más probable que se encuentre en

    a. 6
    b. 5
    c. 2
    d. 1

19. La cámara del agua es el número

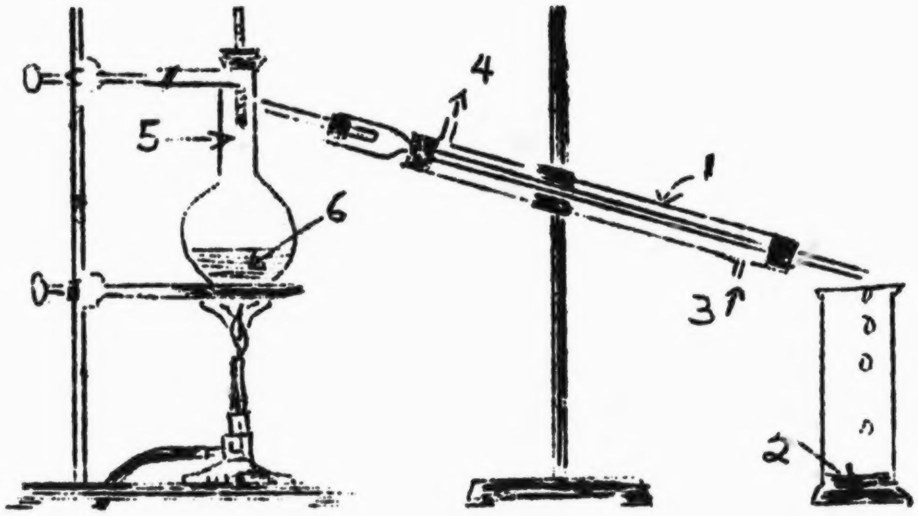
    a. 5
    b. 1
    c. 2
    d. 6

20. El agua que se usa para enfiar entra por el numero

    a. 3
    b. 4
    c. 1
    d. 5

(Continued)

Questions 21-24 refer to the diagram of the apparatus below. Circle the letter which best indicates the answer to each of the following questions: (On your answer sheet)



17. The purest form of the distillate can be found at

a. 6	c. 2
b. 5	d. 1

18. Purified solvent is most likely to be found at

a. 6	c. 2
b. 5	d. 1

19. The water jacket is lettered

a. 5	c. 2
b. 1	d. 6

20. Water, for cooling purposes, enters the apparatus at

a. 3	c. 1
b. 4	d. 5

(Continuación)

21. La presión que un líquido ejerce depende de la

a. densidad del líquido solamente
b. profundidad y densidad del líquido
c. profundidad del líquido solamente
d. altura sobre el nivel del mar

22. Si un niño que pesa 100 lbs. está sentado en un columpio a 3 pies del fulcro, ¿a qué distancia del fulcro deberá sentarse una niña que pesa 50 lbs. para balancear el columpio?

a. 3 pies
b. 15 pies
c. 4 pies
d. 6 pies

23. Un densímetro se usa para medir

a. el volumen del agua
b. humedad del aire
c. densidad relativa del agua
d. densidad relativa de los líquidos.

24. Todas las cantidades vectoriales describen

a. cantidad y dirección
b. cantidad y velocidad
c. velocidad y dirección
d. fuerza y dirección

25. La energía acumulada puede clasificarse como

a. cinetica
b. atómica
c. potencial
d. nuclear

26. Energía se define como

a. trabajo
b. fuerza
c. habilidad para realizar trabajo
d. movimiento

27. Una pirámide descansando sobre su base es un ejemplo de un cuerpo

a. estable
b. inestable
c. neutral
d. pesado arriba

28. Para aumentar la ventaja mecánica de una palanca debemos

a. poner el fulcro más cerca de la resistencia
b. acortar el brazo de potencia
c. aumentar el brazo de resistencia
d. cambiar la resistencia

(Continued)

21. The pressure that a liquid exerts depends upon the

a. density of the liquid only
b. depth of the liquid only
c. the depth and density of the liquid
d. height above sea level

22. If a 100 pound boy were sitting on a see-saw 3 feet away from the fulcrum, how far from the fulcrum would a small girl weighing 50 pounds have to sit in order to balance the boy's weight?

a. 3 feet
b. 15 feet
c. 4 feet
d. 6 feet

23. A hydrometer is used to measure the

a. volume of water
b. humidity of the air
c. relative density of water
d. relative density of liquids

24. All vector quantities describe

a. amount and direction
b. amount and speed
c. speed and direction
d. force and direction

25. Stored-up energy may be classified as

a. kinetic
b. atomic
c. potential
d. nuclear

26. Energy is

a. work
b. a force
c. ability to do work
d. motion

27. A pyramid resting on its base is an example of a body that is

a. stable
b. unstable
c. neutral
d. top heavy

28. In order to increase the mechanical advantage of a crow bar

a. place the fulcrum closer to the resistance
b. shorten the effort arm
c. increase the distance the resistance moves
d. change the resistance

(Continuación)

29. La máquina de un avión tirando con una fuerza de 8 toneladas, y un viento trasero empujando el avión en la misma dirección con una fuerza de 10 toneladas, proveerá una fuerza resultante de

a. 8 toneladas
b. 10 toneladas
c. 18 toneladas
d. 80 toneladas

30. La energía que un cuerpo posee debido a su posición se clasifica como energía

a. de inercia
b. potencial
c. mecánica
d. radiante

31. El calor, la luz y la electricidad son formas de

a. fuerza
b. energía
c. potencia
d. movimiento

32. El punto en el cual el peso de un cuerpo parece estar concentrada se considera como el

a. fulcro
b. equilibrio
c. centro de gravedad
d. medio

33. La coordinación y el equilibrio son controlados por

a. el centro auditivo
b. la espina dorsal
c. el cerebelo
d. medula

34. Una substancia química que ayuda a digerir los nutrimentos se denomina

a. hormona
b. base
c. enzima
d. sal

35. La función principal del sistema de circulación es

a. ayudar a respirar propiamente
b. llevar materiales y gases de una parte del cuerpo a otra
c. mantener la sangre dentro del cuerpo
d. prevenir la malaria

36. Cada célula en el cuerpo

a. provee su propio alimento
b. produce su propio oxígeno
c. necesita suplirse de oxígeno y alimento con regularidad
d. no produce desperdicios

(Continued)

29. An airplane engine pulling with a force of 8 tons, and a tailwind traveling in the same direction exerting a force of 10 tons on the airplane will provide a resultant force of

a. 8 tons
b. 10 tons
c. 18 tons
d. 80 tons

30. The energy of a body due to its position is called

a. inertia
b. potential
c. mechanical
d. radiant

31. Heat, light and electricity are forms of

a. force
b. energy
c. power
d. motion

32. The point at which the weight of a body appears to be concentrated is called

a. the fulcrum
b. the equilibrium
c. the center of gravity
d. the middle

33. Coordination and balance are controlled by the

a. auditory center
b. spinal cord
c. cerebellum
d. medulla

34. A chemical which helps digest nutrients is called a (n)

a. hormone
b. base
c. enzyme
d. salt

35. The main function of the circulatory system is

a. to help breathe properly
b. to carry materials and gases to and from different parts of the body
c. to keep the blood inside the body
d. to prevent malaria

36. Each cell in the body

a. provides its own food
b. produces its own oxygen
c. must receive a regular supply of food and oxygen
d. does not produce waste

(Continuación)

37. El agua de cal se usa para demonstrar la diferencia entre aire inhalado y aire exhalado identificando la presencia de

a. vapor de agua
b. oxígeno
c. dióxido de carbono
d. nitrógeno

38. En la parte de la atmósfera cerca de la tierra, el por ciento de oxígeno es aproximadamente:

a. 1%
b. 5%
c. 21%
d. 78%

39. Generalmente la presión del aire es más alta cuando el aire está

a. frío y seco
b. frío y húmedo
c. cálido y húmedo
d. caliente y seco

40. Cuando la humedad se condensa sobre la superficie fría de los objetos tales como la hierba o la tierra, se le llama

a. granizo
b. nieve
c. lluvia helada
d. rocío

(Continued)

37. Limewater can be used to show clearly the difference between inhaled and exhaled air by identifying the presence of

    a. water vapor
    b. oxygen
    c. carbon dioxide
    d. nitrogen

38. In the lower atmosphere, the approximate percentage of oxygen by volume is

    a. 1%
    b. 5%
    c. 21%
    d. 78%

39. Air pressure is usually highest when the air is

    a. cool and dry
    b. cool and moist
    c. warm and moist
    d. hot and dry

40. When moisture condenses on cool objects such as grass or soil it is

    a. hail
    b. snow
    c. frozen rain
    d. dew

APPENDIX D

CULTURAL RETENTION FORM

NEW YORK CITY BOARD OF EDUCATION
THE SCIENCE-SPANISH RESEARCH PROJECT
JUNIOR HIGH SCHOOL DIVISION

SCALE "B"

Instructions to the Student: We are interested in securing your opinions and knowledge concerning the statements below. If you agree with the statement the answer for you is "Yes"; if you disagree with the statement the answer for you is "No". Since many of these statements ask matters of opinion, different students will answer differently. Each student must answer all the questions; even the ones you are not too sure about.

1. Yes No Jose de San Martin announces baseball games in Puerto Rico.
2. Yes No I can read newspapers or comic books in Spanish.
3. Yes No If I had my choice I would rather visit England than Mexico.
4. Yes No I prefer Spanish dancing to other types.
5. Yes No I like to watch the Spanish shows on TV.
6. Yes No I would like to be in the Pan-American Day assembly show.
7. Yes No I can understand Spanish when it is spoken, but I avoid using it when speaking because I'm not too good at it.
8. Yes No When I go to high school I plan to learn some foreign language other than Spanish.
9. Yes No I usually speak Spanish when I'm with my friends.
10. Yes No I usually refuse to speak Spanish.
11. Yes No I like to be among students who almost always use Spanish when speaking outside of class.
12. Yes No Most of my friends usually speak Spanish.
13. Yes No I am interested in joining Aspira.
14. Yes No When I am in class where the teacher uses only English, I like the teacher to ask me to translate something into Spanish for another student who doesn't understand English too well.
15. Yes No I think people in New York City should speak only in English.

APPENDIX E

RATING FORM FOR SCIENCE TEACHER SPANISH LANGUAGE PROFICIENCY

RATING FORM FOR TEACHER SPANISH LANGUAGE PROFICIENCY

Junior High School______________ Boro_____________ Name of Teacher__________________________

Evaluator____________________________

1. Evaluation of Teacher Oral Communication in Spanish: (Circle appropriate number)

	1	2	3	4	5
Language Patterns usage, structure, grammar	PRACTICALLY NON-EXISTENT	VERY LIMITED	LIMITED	AVERAGE	CORRECT
	1	2	3	4	5
Vocabulary choice of words, use of words	VERY POOR	INSUFFICIENT	LIMITED	ADEQUATE	SUPERIOR
	1	2	3	4	5
Pronunciation correct, clear formation of the sounds	HABITUAL MISPRONUNCIATION	FREQUENTLY INCORRECT	OCCASIONAL MISPRONUNCIATION	USUALLY GOOD	STANDARD NATIVE PRONUNCIATION
	1	2	3	4	5
Intonation rhythm, stress pitch, juncture characteristics	UNSATISFACTORY	POOR	INTELLIGIBLE	NEARLY NATIVE	STANDARD NATIVE

The summary evaluation should take into account the over-all quality of communication in Spanish.

SUMMARY EVALUATION					
Over-all Fluency	1	2	3	4	5
smoothness, facility correctness	INFERIOR	BELOW AVERAGE	ADEQUATE	ABOVE AVERAGE	SUPERIOR

II. Rating in Terms of the Puerto Rican Study Scale

A -Speaks Spanish like a native with no foreign accent or hesitance due to interference of a foreign language.

B -Speaks Spanish with a foreign accent, but otherwise approximates the fluency of a native speaker. Does not hesitate because he must search for Spanish words and language forms.

C -Can speak Spanish well enough for most situations met by typical native speakers, but still must make a conscious effort to avoid the language forms of English. Speaks hesitantly upon occasion because of mental translation.

D -Speaks Spanish in more than a few stereotyped situations, but speaks it haltingly at all times.

E -Speaks Spanish only in those stereotyped situations for which he has learned a few useful words and expressions.

F -Speaks no Spanish

APPENDIX F

ANXIETY SCALE

NEW YORK CITY-BOARD OF EDUCATION
THE SCIENCE-SPANISH RESEARCH EXPERIMENT

NAME__________________________ GRADE______________ BOY____ GIRL__________
(FIRST) (LAST)

CLASS______________ SCHOOL______________ BORO.______________ DATE________________

Scores__________ ______________ __________ YEARS IN PROGRAM 1 2
(Circle)

Read each question to yourself as I read it aloud. Put a circle around the word Yes if you think it is true about you. Put a circle around the word No if you think it is not true about you.

(Mientras yo leo cada pregunta en voz alta léela tú en silencio. Haz un círculo alrededor de la palabra "yes" si tu crees que la oración describe como tu te sientes. Haz un círculo alrededor de "no" si la oración no describe cómo tú te sientes.

Yes No 1. It is hard for me to keep my mind on anything.
Es difícil para mí concentrar la mente en alguna cosa.

Yes No 2. I get nervous when someone watches me.
Si álguien me observa cuando estoy trabajando, me pongo nervioso.

Yes No 3. I feel I have to be best in everything.
Yo creo que debo sobresalir en todo.

Yes No 4. I blush easily.
Me ruborizo facilmente.

Yes No 5. I like everyone I know.
Simpatizo con todas las personas que conozco.

Yes No 6. I notice my heart beats very fast sometimes.
Noto que a veces mi corazon palpita muy ligero.

Yes No 7. At times I feel like shouting.
A veces siento deseos de gritar fuertemente.

Yes No 8. I wish I could be very far away from here.
Yo quisiera estar lejos de aquí.

Yes No 9. Others seem to do things easier than I can.
Otros ninos parecen hacer las cosas con mayor facilidad que yo.

Yes No 10. I would rather win than lose in a game.
Yo prefiero ganar, a perder en un juego.

Yes No 11. I am secretly afraid of a lot of things.
Secretamente, yo siento miedo de muchas cosas.

Yes No 12. I feel that others do not like the way I do things.
Yo pienso que a otras personas no les gusta como yo hago las cosas

Yes No 13. I feel alone even when there are people around me.
Yo me siento solo, aún cuando estoy rodeado de gente.

Yes No 14. I have trouble making up my mind.
Me da trabajo hacer decisiones.

Yes No 15. I get nervous when things do not go the right way for me.
Me pongo nervioso cuando las cosas no me salen bien.

Yes No 16. I worry most of the time.
Yo estoy preocupado la mayor parte del tiempo.

Yes No 17. I am always kind.
Yo soy bondadoso siempre.

Yes No 18. I worry about what my parents will say to me.
Me preocupa lo que mis padres o guardianes puedan decir de mí.

Yes No 19. Often I have trouble getting my breath.
A veces me da trabajo respirar.

Yes No 20. I get angry easily.
Me enojo con facilidad.

Yes No 21. I always have good manners.
Yo muestro buenos modales siempre.

Yes No 22. My hands feel sweaty.
Me sudan las manos.

Yes No 23. I have to go to the toilet more than most people.
Tengo que usar el inodoro más que la otra gente.

Yes No 24. Other children are happier than I.
Otros niños son mas felices que yo.

Yes No 25. I worry about what other people think of me.
Me preocupa lo que otra gente pueda pensar de mí.

Yes No 26. I have trouble swallowing.
Tengo dificultad en tragar.

Yes No 27. I have worried about things that did not really make any difference later.
Yo he estado preocupado por cosas que luego resultaron insignificantes.

Yes No 28. My feelings get hurt easily.
Yo me siento herido fácilmente.

Yes No 29. I worry about doing the right things.
Me preocupo por hacer lo correcto.

Yes No 30. I am always good.
Yo soy bueno siempre.

Yes No 31. I worry about what is going to happen.
Me preocupo por lo que va a suceder.

Yes No 32. It is hard for me to go to sleep at night.
Me da trabajo dormirme por la noche.

Yes No 33. I worry about how well I am doing in school.
Me preocupa si estoy trabajando bien en la escuela.

Yes No 34. I am always nice to everyone.
Yo soy agradable con todo el mundo.

Yes No 35. My feelings get hurt easily when I am scolded.
Cuando me reganan me hieren los sentimientos.

Yes No 36. I tell the truth every single time.
Yo digo la verdad todas las veces.

Yes No 37. I often get lonesome when I am with people.
Con frecuencia, me siento solo cuando estoy entre la gente.

Yes No 38. I feel someone will tell me I do things the wrong way.
Yo pienso que alguien me va a decir que hago las cosas mal.

Yes No 39. I am afraid of the dark.
Tengo miedo a la oscuridad.

Yes No 40. It is hard for me to keep my mind on my school work.
Me es difícil mantener el pensamiento en mi trabajo escolar.

Yes No 41. I never get angry.
Nunca me da coraje.

Yes No 42. Often I feel sick in my stomach.
A veces me siento el estómago revuelto.

Yes No 43. I worry when I go to bed at night.
Me siento preocupado cuando me acuesto por la noche.

Yes No 44. I foten do things I wish I had never done.
A veces hago cosas que no quisiera haber hecho nunca.

Yes No 45. I get headaches.
Me dan dolores de cabeza.

Yes No 46. I often worry about what could happen to my parents.
Muchas veces me preocupa lo que pueda sucederle a mis padres.

Yes No 47. I never say things I shouldn't.
Nunca digo cosas que no debiera decir.

Yes No 48. I get tired easily.
Me canso facilmente.

Yes No 49. It is good to get high grades in school.
Es bueno obtener notas altas en la escuela.

Yes No 50. I have bad dreams.
Tengo suenos malos.

Yes No 51. I am nervous.
Soy nervioso.

Yes No 52. I never lie.
Nunca digo mentiras.

Yes No 53. I often worry about something bad happening to me.
Muchas veces me preocupa que me pase algo malo.

STOP. READ THE FOLLOWING INSTRUCTIONS.

IN THE FOLLOWING QUESTIONS THE WORD "test" IS USED. WHAT IS MEANT BY "test" IS, ANY TIME THE TEACHER ASKS YOU TO DO SOMETHING TO FIND OUT HOW MUCH YOU KNOW OR HOW MUCH YOU HAVE LEARNED. IT COULD BE BY YOUR WRITING ON PAPER, OR BY YOUR SPEAKING ALOUD, OR BY YOUR WRITING ON THE BLACKBOARD. THE WORD "test" MEANS ANY TIME THE TEACHER ASKS YOU TO DO SOMETHING TO FIND OUT HOW MUCH YOU KNOW.

EN LAS SIGUIENTES PREGUNTAS LA PALABRA "prueba" HA SIDO USADA. POR "prueba" ENTENDEMOS AQUI CUANDO LA MAESTRA TE PIDE QUE HAGAS CUALQUIER COSA PARA SABER CUANTO HAS APRENDIDO. LA "prueba" PUEDE REQUERIR QUE ESCRIBAS ALGO EN PAPEL O EN LA PIZARRA, O QUE EXPLIQUES ALGO EN VOZ ALTA LA PALABRA "prueba" AQUI. QUIERE DECIR CUANDO EN CUALQUIER MOMENTO LA MAESTRA TE PIDE QUE HAGAS ALGO PARA SABER CUANTO SABES.

CONTINUE AS BEFORE

Yes No 54. Are you afraid of school tests?
¿Tienes miedo a las pruebas escolares?

Yes No 55. Do you worry a lot before you take a test?
¿Te preocupas mucho antes de tomar una prueba?

Yes No 56. Do you worry a lot while you are taking a test?
¿Te preocupas mucho mientras estas tomando la preuba?

Yes No 57. After you have taken a test do you worry about how well you did on the test?
¿Despues de tomar la prueba, te preocupa si lo hiciste bien o mal?

Yes No 58. Do you sometimes dream at night that you did good on a test you had in school that day?
¿Mientras duermes, suenas a veces que no contestaste bien una prueba que tomaste ese dia?

Yes No 59. When you are taking a test, does the hand you write with shake a little?
¿Cuando estas tomando una prueba, te tiembla un poquito la mano con que escribes?

Yes No 60. When the teacher says that she is going to give the class a test, do you become afraid that you will do poorly?
¿Cuando la maestra dice que va a dar prueba, temes que vas a contestarlo pobremente?

Yes No 61. When you are taking a hard test, do you forget some things you knew very well before you started taking the test?
¿Cuando estás tomando una prueba difícil, te olvidas de cosas que sabías muy bien antes de empezar el examen?

Yes No 62. Do you wish a lot of times that you didn't worry so much about tests?
¿No deseas muchas veces que no te preocuparan tanto las pruebas?

Yes No 63. When the teacher says that she is going to give the class a test, do you get a nervous or funny feeling?
¿Cuando la maestra dice que va dar una prueba a la clase, te sientes algo nervioso y extraño?

Yes No 64. While you are taking a test do you usually think you are doing poorly?
¿Mientras estas tomando una prueba,piensas usualmente que estas haciendolo pobremente?

Yes No 65. While you are on your way to school, do you sometimes worry that the teacher may give the class a test?
¿Cuando vas camino de la escuela, te preocupa a veces que la maestra vaya a dar una prueba?

APPENDIX G

PUPIL PERSONAL DATA SHEET

PERSONAL DATA SHEET

LAST NAME______________________________FIRST NAME____________________CHECK:BOY____;GIRL___
OFFICIAL CLASS7-______SCIENCE TEACHER______________________________J.H.S.________BORO_____
TODAY'S DATE: October____,1964   YOUR DATE OF BIRTH_________________________________AGE__
                                                    month   day   year
PLACE OF BIRTH: COUNTRY________________________________: CITY OR TOWN_________________
HAVE YOU EVER GONE TO SCHOOL ANYWHERE ELSE OTHER THAN IN NEW YORK CITY? ___YES___NO
IF YOU CHECKED YES, TELL US WHERE YOU WENT AND HOW LONG.
Beside New York City, I went to school in _______________________________for _____y
IF YOU WERE NOT BORN IN NEW YORK CITY TELL US WHEN YOU CAME TO NEW YORK CITY.
I came to New York City in 19___.

PLACE A LINE UNDER THE ANSWER TO THE RIGHT THAT BEST EXPLAINS YOUR USE OF LANGUAGE.

I use Spanish in speaking at home Always Mostly Sometimes Hardly Ever Never

I use Spanish outside of my home Always Mostly Sometimes Hardly Ever Never
(not counting school)

I use English in speaking at home Always Mostly Sometimes Hardly Ever Never

I use English outside of my home Always Mostly Sometimes Hardly Ever Never
(not counting school)

I read in Spanish outside of school Always Mostly Sometimes Hardly Ever Never

I write in Spanish outside of school Always Mostly Sometimes Hardly Ever Never

I read in English outside of school Always Mostly Sometimes Hardly Ever Never

I write in English outside of school Always Mostly Sometimes Hardly Ever Never

My father uses Spanish at home Always Mostly Sometimes Hardly Ever Never

My mother uses Spanish at home Always Mostly Sometimes Hardly Ever Never

PLACE A CHECK NEXT TO THE STATEMENT BELOW THAT BEST DESCRIBES HOW YOU FELT ABOUT YOUR SCIENCE CLASSES BEFORE YOU CAME TO JUNIOR HIGH SCHOOL.

________Science was my favorite subject; I liked it better than anything else.
________I liked science more than most other subjects.
________I liked science no more or less than any of the other subjects.
________I liked science less than most of the other subjects.
________Science was the subject I liked the least; the other subjects were better.

APPENDIX H

TEACHER AND PRINCIPAL QUESTIONNAIRES

SCIENCE-SPANISH RESEARCH PROJECT
NEW YORK CITY-BOARD OF EDUCATION
130 West 55th Street
New York 19, N.Y.

Teacher Questionnaire

---

1) What effects has the project had upon student attitude toward learning your subject?

2) What effects has the project had upon student attitudes toward you as a teacher?

3) What effects has the project had upon student attitudes toward the use of Spanish?

4) What effects has the project had upon student attitudes toward further education?

5) What has been the parents' reaction to their children's use of Spanish in school?

6) What effects has the project had upon student behavior in your class?

7) What effects has the project had upon classroom participation?

8) What effects has the project had upon student attendance?

SCIENCE-SPANISH RESEARCH PROJECT
NEW YORK CITY-BOARD OF EDUCATION
130 West 55th Street
New York 19, N.Y.

Teacher Questionnaire (continued)

---

9) What are the positive features you feel this project has from a teacher's viewpoint?

10) What special preparation or planning has been necessary on your part (other) than what you would do with a regular non-project class) to conduct the project class?

11) What are the negative features you feel this project has from a teacher's viewpoint?

12) Please list in the space below any other comments, suggestions, criticisms or situations you wish to present for consideration.

Please check one of the following in response to the statement:

a- I think the project as conducted in my school is ( ) beneficial ( ) inconsequential ( ) handicapping as far as the students are concerned.

b- My overall reaction to the Science-Spanish Project in my school is ( ) favorable ( ) undecided ( ) unfavorable

Name of Teacher ____________________ Subject taught ______________________

Junior High School _______________ Boro ____________ Class __________________

SCIENCE-SPANISH RESEARCH PROJECT
NEW YORK CITY-BOARD OF EDUCATION
130 West 55th Street
New York 19, N.Y.

Principal's Questionnaire

---

1) Please indicate your own personal opinion of the possible advantages or disadvantages of the Science-Spanish Experiment in your school.

2) Please indicate any items of an administrative, supervisory, staffing, guidance, supply or instructional nature, both positive and negative, which you have experienced. This information should be of the type you feel should be considered by a policy making a decision to implement bilingual instruction in the schools.

SCIENCE-SPANISH RESEARCH PROJECT
NEW YORK CITY-BOARD OF EDUCATION
130 West 55th Street
New York 19, N.Y.

Principal's Questionnaire

---

3) Please indicate in the space provided below any comment you wish to make concerning this project's aims or implementation in your school.

4) Please indicate in the space provided any noticeable effect the program had in your school concerning: pupil reaction, parent reaction, staff reaction, guidance department reaction, supervisor reaction. We do not expect you to poll each of these various groups, but, instead, we seek salient items which were brought to your attention as principal during the course of the experiment by any of these groups.

5) Please comment upon the suitability of the curriculum material provided the school for the implementation of the experiment.

SCIENCE-SPANISH RESEARCH PROJECT
NEW YORK CITY-BOARD OF EDUCATION
130 West 55th Street
New York 19, N.Y.

Principal's Questionnaire

---

6) Please indicate any suggestion you have concerning the organizational aspects of bilingual programs like the Science-Spanish Experiment.

7) Please indicate your opinion concerning the principle of bilingual instruction in our schools. Your responses should not be restricted to your particular school situation or to this particular project, but should consider the principle in general.

8) As I now view the Science-Spanish Experiment,
   - ( ) I would like to see it continued if funds and facilities permitted.
   - ( ) I would like to see it tried with a different type pupil.
   - ( ) I would like to see it tried a different subject area.
   - ( ) The pros and cons seem about equal.
   - ( ) I have many reservations about the project.
   - ( ) I would like to see it discontinued.

Principal's Name____________________ Junior High School____________ Boro____.

APPENDIX I

SAMPLE OUTLINE COURSE OF STUDY GRADES 7, 8, 9

Joseph O. Loretan
Deputy Superintendent
of Schools

JUNTA DE INSRUCCION DE LA CIUDAD DE NUEVA YORK
Oficina Del Departamento De Ciencias
EXTENSIÓN Y SECUENCIA DEL CURSO DE ESTUDIOS DE LA ESCUELA INTERMEDIA

Samuel Schenberg
Science Director

Grade 7

Química	Física	Biología	Geología
Composición de la Materia	Electricidad, Magnetismo y Calor	Estructura y Crecimiento De Los Seres Vivientes	Los Rocas, Sus Cambios y Lo Que Revelan
A. ELEMENTOS 1. Definición 2. Metales y No-metales 3. Identificación y clasificación 4. Preparación y propiedades 5. Símbolos	A. LA CORRIENTE ELECTRICA 1. Circuítos 2. Midiendo la electricidad 3. Resistencia electrica 4. Ley De Ohm	A. NECESIDADES DE TODO SER VIVIENTE 1. Cultivo de organismos vivientes en la casa 2. Funciones de todos los seres vivientes 3. El microscopio 4. Requisitos de los seres vivientes	A. HISTORIA ESCRITA EN LAS ROCAS 1. Fósiles-definición 2. Formación de los fósiles 3. Combustibles derivados de fósiles 4. Edad de fósiles y rocas 5. Historia de la Tierra
B. COMPUESTOS Y MEZCLAS 1. Definiciones 2. Preparación 3. Cambios físicos y químicas 4. Propiedades 5. Energía 6. Mezclas	B. MAGNETISMO 1. Caracteristicas 2. Campos magnéticos 3. La Tierra 4. Electromagnetismo 5. Inducción electro-magnética	B. CÉLULAS 1. Teoría 2. Estructura 3. Funciones 4. Protoplasma 5. Tejidos, órganos y sistemas	B. MINERALES Y ROCAS 1. Mineral-definición 2. Usos de los minerales 3. Identificación de los minerales 4. Roca - definición 5. Tipos de rocas
C. TEORÍA ATOMICA 1. Historia de su desarrollo 2. Partículas sub-atómicas 3. Estructura atómica 4. Tabla Periódica 5. Átomos y moléculas	C. CALOR 1. Cambios causados por el calor 2. Medida de la Temperatura 3. Transferencia 4. Calor y temperatura 5. Medida del calor	C. NUTRICIÓN 1. Nutrimentos 2. Pruebas para determinar la presencia de los nutrimentos 3. Nutrición de la planta 4. Usos de los nutrimentos	C. CAMBIOS EN LA TIERRA 1. Evidencias de cambios 2. Volcanes 3. Terremotos 4. Movimientos de la coraza de la Tierra 5. Erosión y desgaste

EXTENSIÓN Y SECUENCIA DEL CURSO DE ESTUDIOS DE LA ESCUELA INTERMEDIA

Grade 8

Química	Física	Biología	Geología
Propiedades de las Mezclas	Fuerzas en Accion	Seres Vivientes - Estructura y Funciones	Formas de Energía en la Atmósfera e Hidrósfera
A. SOLUCIONES 1. Definición 2. Características 3. Factores que afectan la solubilidad 4. Concentración 5. Separación 6. Teoría	A. ENERGÍA 1. Formas 2. Clases 3. Materia y energía Definiciones 4. Definiciones	A. DIGESTIÓN 1. Órganos 2. Funciones 3. Propósito 4. Absorcion	A. LA ATMÓSFERA 1. Definicion 2. Calor 3. Presion 4. Vientos 5. Humedad 6. Precipitación
B. SUSPENSIONES Y EMULSIONES 1. Definición 2. Caracteristicas 3. Separación 4. Estabilización	B. FUERZAS 1. Definición 2. Medida 3. Vectores 4. Estabilidad 5. Momentos 6. Máquinas	B. CIRCULACIÓN, RESPIRACIÓN, Y EXCRECIÓN 1. Órganos de circulación 2. La sangre 3. Órganos de respiración 4. Respiración 5. Inhalación y exhalación 6. Productos de la respiración 7. Eleminación de desperdicios	B. CONDICIONES METEOROLÓGICAS 1. Definición 2. Masas de aire 3. Prediccion 4. Mapas Metereológicos 5. Negociado del tiempo
C. IONIZACIÓN 1. Puntos de ebullición y congelacion 2. Conductividad electrica 3. Teorías 4. Ácidos, bases y sales	C. DENSIDAD Y PRESIÓN 1. Peso 2. Densidad 3. Ley de Arquímides 4. Presión	C. REACCIÓN A ESTÍMULOS EXTERNOS (MODO DE CONDUCIRSE) 1. Definiciones 2. Comportamiento [illegible] las plantas 3. Receptores 4. Sistema nervioso 5. Reacciones a factores del ambiente	C. LA HIDROSFERA 1. Importancia 2. Estructura 3. Composición química 4. Ondas 5. Corrientes 6. Efectos en los seres vivientes

EXTENSIÓN Y SECUENCIA DEL CURSO DE ESTUDIOS DE LA ESCUELA INTERMEDIA

Grade 9

Química	Física	Biología	Geología
Reacciones con Metales	Sonido, Luz y Movimiento	Reproducción y Herencia	Materia y Vida en el Espacio
A. METALES Y FÓRMULAS 1. Definición 2. Tabla periódica 3. Fórmulas 4. Valencia 5. Porcentage de componentes	A. SONIDO 1. Producción 2. Transmisión 3. Características	A. REPRODUCCIÓN ASEXUAL 1. División binaria 2. Gemación 3. Esporulación 4. Propagación vegetativa 5. Regeneración	A. VIAJANDO POR EL ESPACIO 1. Preparación 2. Navegación 3. Riesgos
B. REACCIONES Y ECUACIONES 1. Reacciones comunes 2. Balanceando ecuaciones 3. Tipos de reacciones 4. Conservación de la materia 5. Extracción de metales	B. LUZ 1. Características 2. Transmisión 3. Reflección 4. Refracción	B. REPRODUCCIÓN SEXUAL 1. Plantas 2. Animales	B. SISTEMA SOLAR 1. El Sol 2. La Luna 3. Planetas y otros cuerpos
C. ACTIVIDAD DE LOS METALES 1. Reemplazamiento 2. Actividad relativa 3. Tamaño de los átomos 4. Número de electrones 5. Corrosión	C. MOVIMIENTO 1. Definición 2. Aceleración 3. Leyes de movimiento 4. Inercia 5. Equilibrio de las fuerzas 6. Momentos de las fuerzas 7. Movimiento circular	C. HERENCIA 1. Mitosis 2. Miosis 3. Leyes de Mendel	C. MAS ALLÁ DEL SISTEMA SOLAR 1. Geografía del espacio 2. Características
D. PROBLEMAS DE QUÍMICA 1. Cantidades relativas 2. Cantidas cuantitativas			

Samuel Schenberg, Director de Ciencias
Murray Ehrlich, Ayudante del Director, JHS

Traducido por:
Carmen Sanguinetti
Science-Spanish Experiment

Arnold Raisner, Director

APPENDIX J

SPECIAL FORMAT DIGITEK ANSWER SHEET

BOARD OF EDUCATION OF THE CITY OF NEW YORK

SCIENCE - SPANISH PROJECT

ANSWER SHEET - A

Check One

Name: ______________________ Boy ☐ Girl ☐
LAST FIRST

School: ______________ Teacher: ______________

Science Class: ______________ Today's Date: ______________

DO NOT WRITE IN THIS SPACE

YEAR	1 2 3
STUDENT NUMBER	0 1 2 3 4 5 6 7 8 9
	0 1 2 3 4 5 6 7 8 9
SCHOOL	0 1 2 3 4 5 6 7 8 9
BOR.	1 2 3 4 5
GROUP	0 1
SEX	0 1

SCIENCE II

1 a b c d	6 a b c d	11 a b c d	16 a b c d	21 a b c d	26 a b c d	31 a b c d	36 a b c d
2 a b c d	7 a b c d	12 a b c d	17 a b c d	22 a b c d	27 a b c d	32 a b c d	37 a b c d
3 a b c d	8 a b c d	13 a b c d	18 a b c d	23 a b c d	28 a b c d	33 a b c d	38 a b c d
4 a b c d	9 a b c d	14 a b c d	19 a b c d	24 a b c d	29 a b c d	34 a b c d	39 a b c d
5 a b c d	10 a b c d	15 a b c d	20 a b c d	25 a b c d	30 a b c d	35 a b c d	40 a b c d

SCALE A

SAMPLE	6 YES NO	13 YES NO	20 YES NO	27 YES NO	34 YES NO	41 YES NO	48 YES NO
a. YES NO	7 YES NO	14 YES NO	21 YES NO	28 YES NO	35 YES NO	42 YES NO	49 YES NO
1 YES NO	8 YES NO	15 YES NO	22 YES NO	29 YES NO	36 YES NO	43 YES NO	50 YES NO
2 YES NO	9 YES NO	16 YES NO	23 YES NO	30 YES NO	37 YES NO	44 YES NO	51 YES NO
3 YES NO	10 YES NO	17 YES NO	24 YES NO	31 YES NO	38 YES NO	45 YES NO	52 YES NO
4 YES NO	11 YES NO	18 YES NO	25 YES NO	32 YES NO	39 YES NO	46 YES NO	53 YES NO
5 YES NO	12 YES NO	19 YES NO	26 YES NO	33 YES NO	40 YES NO	47 YES NO	

54 YES NO	56 YES NO	58 YES NO	60 YES NO	62 YES NO	64 YES NO
55 YES NO	57 YES NO	59 YES NO	61 YES NO	63 YES NO	65 YES NO

SCALE B

1 YES NO	6 YES NO	11 YES NO	16 YES NO	21 YES NO	26 YES NO	31 YES NO	36 YES NO
2 YES NO	7 YES NO	12 YES NO	17 YES NO	22 YES NO	27 YES NO	32 YES NO	37 YES NO
3 YES NO	8 YES NO	13 YES NO	18 YES NO	23 YES NO	28 YES NO	33 YES NO	38 YES NO
4 YES NO	9 YES NO	14 YES NO	19 YES NO	24 YES NO	29 YES NO	34 YES NO	39 YES NO
5 YES NO	10 YES NO	15 YES NO	20 YES NO	25 YES NO	30 YES NO	35 YES NO	40 YES NO

DC 1780

Optical Scanning Corporation, Newtown, Pa.

APPENDIX K

SAMPLE INSTRUCTIONAL MATERIALS

1. General Concepts
2. Science Experiment
3. Review Test
4. Vocabulary

NEW YORK CITY-BOARD OF EDUCATION
SCIENCE-SPANISH EXPERIMENT
JUNIOR HIGH SCHOOL DIVISION

Sección Física Grado 8 Pág.____ Notas

CONCEPTOS GENERALES

Densidad y Presión

Toda materia tiene peso.

El peso de un cuerpo se determina por la fuerza de gravitación ejercida sobre ese cuerpo.

La densidad de un cuerpo es el peso de una unidad de volumen de ese cuerpo.

La densidad de una substancia puede compararse con la densidad del agua.

Un objeto cuya densidad es mayor que la del agua se sumergirá en agua.

Un objeto cuya densidad es menor que la del agua flotará en agua.

El Principio de Arquímides dice que la aparente pérdida en el peso de un cuerpo en agua es igual al peso del agua desplazada.

La presión ejercida por un cuerpo depende de la fuerza total y el área sobre la cual actúa.

$P = F/A$

La fuerza ejercida por un líquido es igual a la altura X area de la base X densidad del líquido.

CONCEPTOS GENERALES

Densidad y Presion

Sección Física Grado 8 Pág.____ Notas

(Continuación)

La presión del líquido es igual a la fuerza sobre la superficie unidad.

Mientras más **alta** es la columna de un líquido , mayor es la presión.

Un fluído pasa de un punto de mayor presión a uno de menor presión.

Traducido y Adaptado
por

Carmen S. Sanguinetti
Subject Supervisor
Science-Spanish Project

NEW YORK CITY BOARD OF EDUCATION
THE SCIENCE-SPANISH RESEARCH EXPERIMENT
JUNIOR HIGH SCHOOL DIVISION

Seccion Biología Grado 7 Pág._____ Notas

EXPERIMENTO #14

PROPÓSITO: Comparar la cantidad de vitamina C que se encuentra en diferentes jugos.

MATERIALES:

1. Jugos de frutas traídos de la casa. (si son concentrados deben diluírse de acuerdo con las instrucciones)
2. Frásco cuentragotas con una solución de indofenol al 0.1%
3. Gradilla con 4 o más tubos de ensayo
4. Frasco cuentagotas con una solución de bicarbonato sódico
5. Cuentagotas

PROCEDIMIENTO: Con tus compañeros de laboratorio desarrolla un plan de experimentos para resolver cada uno de los problemas siguientes:

1. Determinar cuál de los jugos que trajiste de la casa contiene mas vitamina C. Debes usar la misma cantidad de indofenol para que la comparación sea válida.
2. Preparar una tabla que incluya todos los jugos, empezando con el que tiene más vitamina C y terminando con el que tiene menos. Si al hacer las pruebas obtienes los mismos resultados con dos o más de los jugos,

EXPERIMENTO #14 (Continuación)

Seccion Biología Grado 7 Pág.____ Notas

diseña un método para determinar si realmente hay alguna diferencia entre ellos.

3. Determinar si la cantidad de vitamina C en los jugos se afecta cuando se les añade bicarbonato sódico.

RESUMEN:

1. ¿Qué conclusiones puedes derivar de esta lección?

2. ¿Cómo controlaste los experimentos para poder comparar el contenido de vitamina C en los distintos jugos?

3. Cuando dos o mas jugos fueron decolorados por la misma cantidad (el mismo numero de gotas) de indofenol, ¿cómo determinaste si había alguna diferencia en el contenido de Vitamina C?

4. En tu cuaderno, escribe un informe describiendo lo que hiciste en esta lección de laboratorio.

Traducido y Adaptado por
Carmen Sanguinetti
Science-Spanish Project
Junior High School Division

AR:11

NEW YORK CITY-BOARD OF EDUCATION
SCIENCE-SPANISH-PROJECT
JUNIOR HIGH SCHOOL DIVISION

Sección Geología Grado 7 Pág.____

Preguntas de Repaso

Direcciones: Haz un círculo alrededor de la letra de la contestación que mejor completa cada oración.

1. Un científico que estudia la historia y desarrollo de la tierra es conocido como un

a) mineralogista
b) astrónomo
c) paleontólogo
d) sismólogo
e) petrólogo

2. El "Proyecto Moho" tiene el propósito de penetrar dentro de

a) la atmósfera de la Tierra
b) el océano mas profundo
c) el manto de la Tierra
d) un glaciar
e) el corazón de la Tierra

3. "Cleavage" se refiere a la tendencia de algunos minerales a

a) romperse en forma dispareja
b) romperse en planos definidos, de superficies suaves
c) romperse en pedazos
d) romperse en superficies curvas
e) producir una raya en la porcelana

4. Un "Conglomerado" está formado de yacimientos de rocas hechas de

a) cieno
b) arena
c) grava
d) cenizas volcánicas
e) cal

Sección Geología Grado 7 Pág.______

5. El granito se compone de cuarzo, feldespato y generalmente

a) calcita
b) mica
c) talco
d) yeso
e) apatita

6. Los terremotos se deben mayormente a

a) plegamiento
b) fallas
c) derrumbes
d) volcanes que fluyen lentamente
e) las mareas

7. La evidencia de que el Estado de Nueva York fué en un tiempo una región árida está basada en la existencia de

a) piedra caliza
b) pizarra
c) depósitos de sal
d) depósitos glaciales
e) erráticos

8. La intrusión ígnea que produce un domo o cúpula en la capa de roca que está arriba se llama

a) "cone"
b) "dike"
c) "laccolith"
d) "sill"
e) "spine"

9. Los depósitos de petróleo se encuentran mayormente en

a) "synclines"
b) "monoclines"
c) "anticlines"
d) "faults"
e) "rifts"

10. Un valle con forma de "U" se forma por

a) ríos
b) vientos
c) glaciares
d) olas
e) gravedad

11. Un río viejo se identifica generalmente por

a) su forma de "V"
b) los rápidos
c) meandros
d) muchos tributarios
e) lagos

12. Una duna tiene un leve declive en

a) el sotavento ("leeward side")
b) todos los lados
c) el barlovento ("windward side")
d) su cresta
e) el lado sur

Sección Geología Grado 7 Pág.______

13. El proceso por el cual las rocas se rompen por medio de la congelación del agua se llama

a) erosión
b) desgaste ("weathering")
c) corrosión
d) sedimentación
e) deposición

14. La historia de la Tierra puede ser estudiada mejor por

a) la edad de un río
b) desarrollo de las montañas
c) descomposición radioactiva
d) la sal en los océanos
e) carbón 14

15. Las intrusiones ígneas comparadas a las rocas en que han penetrado

a) son más jóvenes
b) son más viejas
c) son de la misma edad
d) no tienen relación alguna en edad
e) no tiene relación a ninguna de las mencionadas

16. Los fósiles que se encuentran en rocas que tienen la misma edad se llaman

a) moldes
b) fósiles índices
c) impresiones
d) concreciones
e) inclusiones

17. La abertura de un volcán se llama

a) cuello
b) cráter
c) hoyo
d) desagüe
e) respiradero

18. El elemento más abundante en la costra de la Tierra es

a) nitrógeno
b) silicio
c) oxígeno
d) hierro
e) helio

19. La mena o mineral metalífero del cual se extrae plomo es

a) hematita
b) bauxita
c) galena
d) calcopirita
e) pechblenda

20. Un mineral que podemos rayar con la una es

a) cuarzo
b) yeso
c) un centavo
d) feldespato
e) fluorita

Direcciones (21-25): Completa cada oración con la palabra o expresión que la haga más correcta.

26. Líneas que conectan sitios de la misma elevación se llaman __________

27. Generalmente los fósiles se encuantran en __________

28. Erosión producida por el viento es más efective en regiones que tienen un clima __________

29. El mineral principal en la piedra caliza es __________

30. Las caídas de agua o cascadas son características de __________

31. Cuando el magma se enfría muy despacio generalmente produce __________

32. La pizarra es generalmente __________ metmorfoseada.

33. La suma total de los procesos por los cuales las rocas se rompen mecánica y físicamente en pedazos pequeños se denomina __________

34. Una grieta en la costra de la Tierra a lo largo de la cual ha habido dislocación de una roca se llama __________

35. Erráticos son depósitos dejados por __________

Tradudido y Adaptado
por
Carmen Sanguinetti
Science-Spanish Project
Junior High School Division

NEW YORK CITY BOARD OF EDUCATION
THE SCIENCE-SPANISH RESEARCH EXPERIMENT
JUNIOR HIGH SCHOOL DIVISION

Seccion Geología Grado 7 Pág. ____

VOCABULARIO

1)	Apatita	Apatite
2)	Astrónomo	Astronomer
3)	Atmósfera	Atmosphere
4)	Barlovento	Windward
5)	Cal	Lime
6)	Cieno	Silt
7)	Conglomerado	Conglomerate
8)	Derrumbe	Landslide
9)	Duna	Dune
10)	Erráticos	Erratics
11)	Falla	Fault
12)	Glaciar	Glacier
13)	Granito	Granite
14)	Grava	Gravel
15)	Meandros	Meanders
16)	Mica	Mica
17)	Mineralogista	Mineralogist
18)	Paleontólogo	Paleontologist
19)	Piedra Caliza	Limestone
20)	Pizarra	Slate
21)	Plegamiento	Folding
22)	Sotovento	Leeward
23)	Talco	Talc
24)	Yeso	Gypsum

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OFFICE OF EDUCATION
WASHINGTON 25, D.C.

ERIC DOCUMENT RESUME

DATE OF RESUME

1. ACCESSION NO.

2. ERIC SATELLITE CODE

3. CLEARING HOUSE CONTROL NO.

4. SOURCE New York City, Board of Education
Bureau of Educational Research
110 Livingston Street, Brooklyn, N.Y. 11201

5. TITLE Science Instruction in Spanish for Pupils of Spanish Speaking Background - An Experiment in Bilingualism. Project No. 2370, Final Report (7/1/64 - 6/30/67)

6. AUTHOR(S) Raisner, A. - Bolger, P. - Sanguinetti, C.

7. DATE

8. PAGINATION

9. REFERENCES 46 ref.

10. REPORT/SERIES NO.

11. CONTRACT NO. 407-9

12. PUBLICATION TITLE

13. EDITOR(S) McClelland, Samuel D. and others

14. PUBLISHER New York City, Board of Education

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15. ABSTRACT *(250 words max.)*

The social and economic milieu of our nation has changed in ways which tend to exclude the linguistically hampered and culturally disadvantaged student from having feasible prospects for reaching the level of academic success that is now necessary for suitable vocational adjustment. The Science-Spanish study explored the possibility of using the in-migrant students' background language as a medium of instruction in order to develop academic skills through a success program which develops cultural pride and a positive sense of self-identification.

The instructional program attempted to improve achievement in science, accelerate the mastery of English, provide greater proficiency in Spanish and to foster positive student attitude toward "self" and school which could serve as the basis for increased effort in all other areas of study.

In each of 16 junior high schools an experimental and matched control class were organized. All students were approximately two years retarded in English reading and had maintained a basic level of Spanish-speaking ability. The experimental class studied its course in the prestige area of science under the tutelage of a bilingual teacher who used Spanish to the extent possible. The control classes studied the same course in English. An accelerated course in Spanish was provided for the experimental class in order to increase student language proficiency.

It was found that experimental students did better in Science than did the control students. Progress in the mastery of English was not hampered by the introduction of bilingualism. Increased academic success did not extend to other subject areas. The level of school anxiety was lowered and a positive attitude toward "self" and background culture was manifest.

16. RETRIEVAL TERMS *(Continue on reverse)*

Bilingualism
Biculturalism
Pluralism
Foreign Language Maintenance
Disadvantaged

17. IDENTIFIERS

Bilingual Experiment

Figure 3. ERIC Document Resume